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BY

J. ERIC THOMPSON

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Determinants

The term "determinant" was employed by the late John E. Teeple to cover those dates which the Mayas, as a result of their calculations, employed to show how much the solar year had exceeded their ordinary year of 365 days, which was free of any intercalation. To us as the inheritors of centuries of accurate calculations aided by precise mathematical instruments the answer to such a question is clear. We know that at the end of 1,000 years the tropical year will have gained a little more than 242 days over a 365-day year, but the Mayas had no such world pool of astronomical information on which to fall back, nor had they precise instruments for measuring the passage of time.

The accuracy they attained despite these disadvantages has been demonstrated by Teeple. In this article his methods have been used with somewhat more freedom, but this is permissible now that his case has been established.

Determinants are of several kinds. They may show how much the dates 8 Cumhu and 0 Pop have advanced in the course of centuries from their original locations at the start of the Maya calendar, or *vice versa*. The position 8 Cumhu marks the opening of the Maya calendar nearly 4,000 years before the dates at Quirigua that will be discussed, and 0 Pop marks the start of the first Maya year of 365 days seventeen days later. These are markers of the mythical start of the Maya calendar corresponding to a certain extent with the *ab urbe condita* of the Romans. In addition it was a practice to show how much the ending month positions of Hotuns had advanced in the tropical year since the original 8 Cumhu, and *vice versa*. The choice of which system to use on a given occasion may have been determined by the degree of luck attaching to the various days reached by different calculations.

A general discussion of the Maya calendar would be out of place here, for it is taken for granted that the reader is familiar with a knowledge of the Maya calendar such as can be obtained from Sylvanus G. Morley's "An Introduction to the Study of the Maya Hieroglyphs" (1915) and Teeple's determinant thesis expounded in his "Maya Astronomy" (1930).

I decided to make an intensive study of the determinants at Quirigua because non-Tun–ending dates at this site are not very numerous, and one can therefore be more certain of what dates should be paired in seeking determinants. Furthermore, Quirigua dates cover only a comparatively short period of about a hundred years, thus simplifying the task. This period marks the height of Maya intellectual achievement. Here also are found many determinants reckoned from a different base than the 8 Cumhu at Cycle 13.

THE INAUGURATION OF THE MAYA LONG COUNT

A few months before his death Teeple wrote me that he thought it possible that the Mayas might have started the Long Count at 7.6.0.0.0, 11 Ahau 8 Cumhu. His argument was that if the Mayas had reckoned five leap days to a Katun, they would have considered that any day in their 365-day year would be in the same position in the solar year at the end of 73 Katuns ($73 \times 5 = 365$). This number expressed in Maya notation would be 3.13.0.0.0.

Wishing to give their newly invented calendar a historical background, they could take a base 73 Katuns, or any multiple of this, backward, and call it the start of the calendar. According to their calculations the mythical start would occupy the same position in the solar year. Actually, if this thesis be correct, the inaugurators of the Long Count projected the start of their calendar twice this distance into the past, allowing 146 Katuns for the past; this would be written 7.6.0.0.0. Thereby they obtained a historical base with the same month position (8 Cumhu), and, according to their calculations, the same position in the solar year.

Actually these corrections were incorrect, for according to Gregorian calculations, which themselves are not quite accurate, the 365-day calendar and the solar year would coincide after a little more than 76 Katuns, or 3.16.8.17.0 in Maya notation. However, many centuries passed before such accuracy was reached by Old World astronomers. It does not appear probable that the Mayas could have reached such a stage at the inception of their calendar, for such accuracy could have resulted only from accurate observations extending over hundreds of years. Perhaps we have all been prone to attribute too many marvels to the Mayas. I myself am not guiltless, for on a previous occasion (Thompson, 1927, p. 12) I suggested that the inception of the calendar might have been based on twice this 3.16.8.17.0 equation. I now realize

that I was crediting the Mayas with too great accuracy for such an early period in their history.

If the Mayas did, indeed, reckon 146 Katuns for past history, they would have started their calendar at 7.6.0.0.0, 11 Ahau 8 Cumhu. In this connection it is interesting to note that up into the seventeenth century the Katuns were numbered in a sequence that always made Katun 11 Ahau the first of the series. This suggests that the Maya count of Katuns was believed to have started with a Katun 11 Ahau. There is more direct evidence than this.

In the Chilam Balam of Chumayel (Martinez, p. 24) there is an account of the dawn. This is said to have taken place in a Katun 11 Ahau, and we are also told that 13 *pic dzac* and 7 *pic dzac* had passed since the beginning of the earth. The term *pic dzac* means a very great number. Martinez suggests that it may mean 13 Cycles and 7 Cycles. This would fit in very well with the 7.6.0.0.0 base, for 13 Cycles would account for the 13 Cycles to 4 Ahau 8 Cumhu, and the other seven would carry the date into the current Cycle. The only two occurrences of Katun 11 Ahau in Cycle 7 are 7.6.0.0.0 and 7.19.0.0.0. The latter ends on 11 Ahau 3 Mol, but Mol has no significance, whereas the former, as we have seen, ends on 8 Cumhu.

If the Long Count did, indeed, start to function at 7.6.0.0.0, one would expect to find in the inscriptions determinants reckoned from this base once the length of the solar year was more accurately known. This was a conclusion reached by Teeple shortly before his death. As accuracy increased, it would become apparent that 7.6.0.0.0, 11 Ahau 8 Cumhu and 13.0.0.0.0, 4 Ahau 8 Cumhu did not occupy the same position in the solar year, and the Maya astronomer would have been faced with the problem of deciding whether to measure the advance of the solar year over the 365-day year using 7.6.0.0.0 as a base or 13.0.0.0.0. Teeple wrote me shortly before his death that he considered that both bases were used, particularly at Quirigua.

The inscriptions on the Quirigua stelae will now be taken up in the order of their erection, in an endeavor to discover the types of determinants used at this city, and to see what progress can be noted during the eighty-odd years when stelae were being erected.

STELAE J AND E

The earliest deciphered stela at Quirigua has an Initial Series giving the Hotun ending 9.15.15.0.0, 9 Ahau 18 Xul, but the inscrip-

tion is very worn, and nothing else is legible. Five Tuns later, another stela was erected, but again nothing is decipherable save the Initial Series. The next monument to be erected was Stela J which marks with an Initial Series the Hotun 9.16.5.0.0, 8 Ahau 8 Zotz. In addition there are two other dates given, related to the Initial Series in the following manner:

9.16. 5. 0. 0,	8 Ahau 8 Zotz
18. 3.14	Subtract
9.15. 6.14. 6,	6 Cimi 4 Tzec
9.16. 5. 0. 0,	8 Ahau 8 Zotz (not repeated)
1.11.13. 3	Subtract (written 0.11.13.3)
9.14.13. 4.17,	12 Caban 5 Kayab

The 12 Caban 5 Kayab date is also found as an Initial Series date on Stelae E and F, and again as a Calendar Round date on Altar G, a much later monument. It has been suggested that this date marked the foundation of Quirigua, but this theory was subsequently exploded by the discovery of other stelae too worn to be dated but clearly earlier than this date on stylistic grounds. Furthermore, excavations carried out by Ralph Linton below the main plaza floor revealed a lengthy occupation of the site (Hewett, 1916, p. 159).

The fact that this date occurs on monuments as much as thirty years apart in date of erection clearly shows that it did not serve to mark some current social event or astronomical phenomenon. One is led to the conclusion that it must have functioned as a basis of reckoning, corresponding in importance to the later 9.16.12.5.17, 6 Caban 10 Mol determinant at Copan. If the 12 Caban 5 Kayab date is a determinant, one would expect it to follow the general rule that a determinant lies in the Katun or Lahuntùn which it links with the past. The Katun following the date in question is 9.15.0.0.0, 4 Ahau 13 Yax. Let us try to connect this date with the date selected as the possible inauguration of the Long Count. The interval between 7.6.0.0.0 and 9.14.13.4.17 is 959 years. By strict Gregorian calculation a correction of 233 days is required. Adding 233 days to 5 Kayab we reach 13 Yax. In other words, the Quirigua astronomers calculated that at this date 5 Kayab occupied the position that 13 Yax had occupied at the inauguration of their calendar, making no error in the course of over 950 years. Probably the calculation was based on the date 9.15.0.0.0, seven years later. In that case the calculation was about a day and a half short of Gregorian. In any case the calculation is remarkably accurate.

The Mayas emphasized this date because it marked not only a Katun ending, but also a quarter of a Cycle, as important to them as a centenary would be to us. More so, in fact, because we are not so wrapped up in numbers as the Mayas were. Furthermore, this date marks the end of an even number period of 13 Tuns and 18 Tonalamatls, for it is only after this period that the day 4 Ahau that marked the end of Cycle 13 can repeat itself at the end of a Tun.

A better explanation of this computation can be made by using dates in our own calendar. For this purpose I shall employ the Goodman-Thompson correlation (Thompson, 1927), although one must bear in mind that this correlation has not yet been proved correct, but it may be considered to have greater probabilities of being so than any other correlation so far proposed. At 9.15.0.0.0, 4 Ahau 13 Yax the month position 13 Yax fell on August 20, but at 7.6.0.0.0, according to Quirigua calculation, 13 Yax fell on April 10, but August 20 was occupied by 5 Kayab. Hence the association of the two dates.

The calculation might have been reversed, and, instead of finding the position of the Maya year corresponding to August 20 at 7.6.0.0.0, the calculation might be to take the position occupied by 13 Yax at 7.6.0.0.0 that is April 10, and find out what position in the 365-day year it would occupy at 9.15.0.0.0. Actually we find this equation on a lintel from Yaxchilan, now in Berlin. There is an error in the Initial Series, but without the slightest doubt it is meant to read 9.15.6.13.1, 7 Imix 19 Zip. Here the calculation allows for a correction of 231 days in 973 years, for 13 Yax+231=19 Zip.

Another example of a determinant of this type has just been recovered at Piedras Negras by the expedition of the Museum of the University of Pennsylvania under the leadership of J. Alden Mason. Although the results of this expedition have not yet been published, I am enabled to make use of this date through the courtesy of J. Alden Mason and the Museum of the University of Pennsylvania.

The date, which is recorded on the seat of a throne, reads "End of Katun 15, 12 Manik 5 Zotz." Naturally 12 Manik 5 Zotz does not end Katun 15, but one can assume that the glyphs indicate that 12 Manik 5 Zotz is the determinant of the date that ends Katun 15. The same method of writing determinants occurs three times at Quirigua (Fig. 22).

The Long Count position of 12 Manik 5 Zotz nearest to 9.15.0.0.0, 4 Ahau 13 Yax is 9.15.18.16.7. The time elapsed from 7.6.0.0.0 to this latter date is 985 years, requiring a correction of 237 days

at the rate of 24 days a century. The calculation, as with the Yaxchilan determinant, is made by placing 13 Yax at 7.6.0.0.0, and finding the date reached at the present time. The calculation is: 13 Yax+237=5 Zotz. In other words 5 Zotz occupies the position in the tropical year at 9.15.18.16.7 which was occupied by 13 Yax at 7.6.0.0.0. The date 13 Yax is employed because it is the month position occupied by Katun 15. The calculation is more accurate than that of Yaxchilan. The interval is six days greater than in the latter calculation, but three of these days are accounted for by the fact that the Piedras Negras calculation is made twelve years later, for during this period a further three-day intercalation has accumulated.

Copan, as Teeple has pointed out, calculated the determinant from Cycle 13, the formula being 18 Cumhu+200=13 Yax. Naranjo appears to have used the formula in a slightly less accurate form on Stela 30, where the Calendar Round date 13 Ahau 3 Uayeb is given—3 Uayeb+195=13 Yax. The calculation is made eighteen years earlier, hence the correction is four to five days less, 195 instead of 200. An earlier and less accurate calculation may be given on this monument: 2 Pop+191=13 Yax. At Quirigua on Stela D (p. 378) we shall find this same calculation as 3 Pop+190=13 Yax.

We have information, then, that five important Maya cities made calculations as to the advance of this Katun ending in the tropical year. Two used a 7.6.0.0.0 base, two the 13.0.0.0.0 base, and Quirigua used both. The second date always found in association with 12 Caban 5 Kayab is 6 Cimi 4 Tzec. This date also occurs in the hieroglyphic stairway at Copan, and is there found in association with the Hotun ending 9.14.15.0.0, 11 Ahau 18 Zac. At first glance this might not seem a very important date, but it is recorded by no less than seven monuments—the greatest number that records any odd Hotun ending in the whole of Maya history except the Hotun 9.17.5.0.0. If we are correct in believing that the Maya calendar was inaugurated at 7.6.0.0.0, 11 Ahau 8 Cumhu, we have a possible explanation of the importance of this date to the Mayas. It ends on the day 11 Ahau, the day on which the Maya Long Count was inaugurated. Similarly the Katun 9.18.0.0.0 is recorded no less than sixteen times, more than any other date in the whole of Maya history. It also ends on a day 11 Ahau. I do not suggest that this was the sole cause of this large number of monuments, but an examination of Hotun endings shows that there was a tendency to erect monuments on these dates if the coefficient of Ahau was

11, 13 or 4. The number thirteen, of course, was sacred to the Mayas, and 4 Ahau, as pointed out, was an anniversary of the original position at Cycle 13. There may have been a second reason for emphasizing this Hotun ending 9.14.15.0.0, as will be shown.

As these two dates 6 Cimi 4 Tzec and the Hotun ending are linked together, let us see if we can apply the determinant rule to them. Between 7.6.0.0.0 and 9.14.15.0.0, 11 Ahau 18 Zac, 961 years have whiled, and strict Gregorian calls for a correction of 233 days, or 231 days if the correction is calculated at 24 days a century. Adding 231 to 18 Zac we reach 4 Tzec. In the correlation followed in this article 4 Tzec falls on May 1, when the sun was exactly overhead in its passage northward. The Quirigua astronomers also, of course, calculated that the sun was overhead at 18 Zac at 7.6.0.0.0, but there is still another reason why the Hotun should be emphasized. It is within four days of the anniversary in the tropical year of 8 Cumhu at 7.6.0.0.0. In short:

11 Ahau ends 7.6.0.0.0.
11 Ahau ends 9.14.15.0.0.
8 Cumhu at 7.6.0.0.0 falls on September 11.
18 Zac at 9.14.15.0.0 falls on September 15.
18 Zac at 7.6.0.0.0 falls on May 1, when the sun is overhead.
4 Tzec at 9.14.15.0.0 falls on May 1, when the sun is overhead.

Of course these are based on apparent Maya calculations. The 8 Cumhu is nowhere brought into the discussion. Here, too, we are discussing round numbers; the base of 18 Zac in the Zac-Tzec calculation is here reckoned as nine years later to correspond to the addition of nine years at 9.14.15.0.0. The Quirigua astronomers may have calculated the interval as 970 years, not as 961. In that case the Cumhu-Zac correspondence would be closer.

Actually, we do not know that the Mayas paid much attention to the passage of the sun across the zenith. Mrs. Nuttall has collected certain evidence of the practice in ancient Mexico and Peru. Recently I came across a possible reference to it in an old Kekchi almanac written after the reformation to the Gregorian calendar. Against May 1 is written a phrase which Father Allen A. Stevenson of the Catholic Mission at Punta Gorda has kindly translated for me as "Sun within." This date would be about correct for the latitude of the southern Alta Vera Paz, as well as for Quirigua.

These two determinants, 12 Caban 5 Kayab and 6 Cimi 4 Tzec, are, as noted, associated not only on Stela J, but also on Stelae F and E. On these two last monuments the importance of the former date is enhanced, as it is given as an Initial Series. Around these

two Calendar Round dates astrological calculations centered, and dates were warped and woofed.

On Stela E, dedicated at 9.17.0.0.0, 13 Ahau 18 Cumhu, the date 9.16.11.13.1, 11 Imix 19 Muan is associated with 6 Cimi 4 Tzec, although there is an apparent mistake of three Tuns in addition. Teeple has suggested that this is a determinant of 18 Zip, the month position of Cycle 10. This is probable but I believe that the reckoning was from 7.6.0.0.0 and not from Cycle 13 by a Julian reckoning, as Teeple originally believed. Since the inauguration of the Long Count 997 years have whiled, which would require a correction by strict Gregorian of 241 days. Then 18 Zip+241=19 Muan.

On this stela the 12 Caban 5 Kayab date is recorded as an Initial Series. It is linked to the date 9.15.0.0.0, of which it is the determinant, by a Secondary Series.

STELA F

The 12 Caban 5 Kayab date is given here again as an Initial Series, and is linked to 6 Cimi 4 Tzec by a Secondary Series.

On the opposite side of the monument is given a date 1 Oc 13 Yax preceded by a glyph that clearly reads "End of Cycle 13" (Fig. 22, *a*). Spinden reads this date as 1 Ahau 13 Yaxkin, but the day sign has the deep nose and mouth of Oc, and the month glyph shows the broken cartouche found in the Cauac months, the superfix identifying it as Yax. An examination with a strong magnifying glass of Maudslay's photograph shows that the Kin element is not present, but faint details of the Cauac element can be seen. Hermann Beyer in a letter dated February 24, 1932, writes, "I think you are right in reading it Yax. The photo in Maudslay is too small to see details distinctly, but what can be made out speaks for Yax not Yaxkin."

The supposition is that this date marks the advance of the solar year from Cycle 13. The nearest occurrence of this date to the Hotun which the monument commemorates is 9.16.5.7.0. Since Cycle 13, 3,870 years have whiled, requiring a correction of 208 days by strict Gregorian. Now 8 Cumhu+210=13 Yax, which is pretty accurate, but I believe we are attributing too much accuracy to the Quirigua astronomers of this date. Evidence from other stelae shows that calculations were made on a basis of roughly 24 days of correction a century. On the opposite side of the stela the inscription closes with a reference to the current Katun ending 9.17.0.0.0, 13 Ahau 18 Cumhu, and if the correction is based on 24 days a

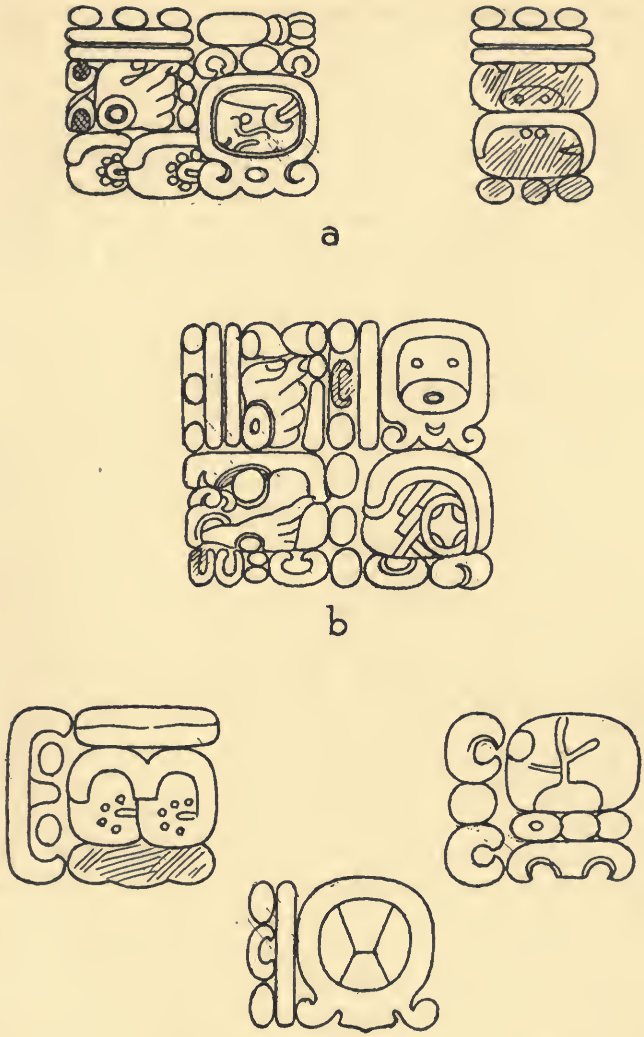

Fig. 22

Cycle Determinants at Quirigua Slightly Restored: *a*, 1 Oc 13 Yax, End of Cycle 13, Stela F; *b*, 7 Ahau 3 Pop, End of Cycle 13, Stela D; *c*, 9 Eznab 1 Kankin, End of Cycle 10, Altar G. The coefficient of Eznab is here shown as 7, following Maudslay's drawing, although a coefficient of 9 is clearly necessary.

century, it will amount to 199½ days: 18 Cumhu+200=13 Yax. This is the more probable explanation of the reference.

STELA D

On this monument erected to commemorate the Hotun ending 9.16.15.0.0, 7 Ahau 18 Pop the 12 Caban 5 Kayab and 6 Cimi 4 Tzec dates do not occur. Instead we find an Initial Series reading 9.16.13.4.17, 8 Caban 5 Yaxkin. This date is the second Katun anniversary of the original 12 Caban 5 Kayab, and the Hotun that the monument commemorates is also 2 Katuns from the original Hotun in which 12 Caban 5 Kayab occurred. Actually this 8 Caban 5 Yaxkin date, besides being the second Katun anniversary of 12 Caban 5 Kayab, expressed on the monument by glyphs reading "End of 2 Katuns," is also itself a determinant. Since 7.6.0.0.0 a period of 999 years has elapsed, requiring a correction of 242 days by strict Gregorian count, but we have seen that at that period the astronomers counted at the rate of 24 days of intercalation a century, which would require a 240-day correction. Now 5 Yaxkin at 7.6.0.0.0 is now 0 Pop by this calculation, and 0 Pop was one of the points chosen for determinant calculations: 5 Yaxkin+240=0 Pop.

On this same inscription are four glyphs reading "End of Cycle 13, 7 Ahau 3 Pop" (Fig. 22, *b*). One supposes that this is a determinant of the same type as the 1 Oc 13 Yax date of Stela F. The position of this date in the Long Count nearest the date of the monument's erection is 9.14.17.8.0, a couple of years before the famous 9.15.0.0.0, 4 Ahau 13 Yax, which evoked the 12 Caban 5 Kayab date. The interval from Cycle 13 is 3,842 years, which on a reckoning of 24 days a century will require an intercalation of 192: 3 Pop+190=13 Yax. Copan, as has been shown, calculated 18 Cumhu as this determinant two years later, but Copan was more advanced than Quirigua, and was calculating close to a strict Gregorian year. Such accuracy is not yet visible at Quirigua. It is difficult to realize that an error of as little as a second in the length of the day would amount to over sixteen days in the interval that elapsed between Cycle 13 and the date in question. Quirigua made an error of eleven days on this monument; the Julian calendar in general use in Europe until the second half of the sixteenth century and in partial use until the twentieth century would have been some twenty-nine days in error. It will be seen that Quirigua with the passing years improved her calculations.

STELA C

Stela C, with its companion Stela A, was erected to commemorate the Hotun ending 9.17.5.0.0, 6 Ahau 13 Kayab. This is the first monument erected at Quirigua since Stela J that has no reference, direct or indirect, to 12 Caban 5 Kayab and 6 Cimi 4 Tzec. A new movement is afoot in Quirigua, and through the warp of the unchanging day count a new woof is being run.

The east side of Stela C is occupied by an Initial Series recording 13.0.0.0.0, 4 Ahau 8 Cumhu, the mythical start of the Maya count. The west side records by another Initial Series the early non-contemporaneous date 9.1.0.0.0, 6 Ahau 13 Yaxkin, followed by a Secondary Series which brings the date forward to 9.17.5.0.0, 6 Ahau 13 Kayab, the date of the monument. Finally at the base of the monument are recorded the Calendar Round dates (9.17.4.10.12) 1 Eb 5 Yax and (9.17.4.11.0) 9 Ahau 13 Yax. These dates are joined by a Secondary Series of 8 Kins written with the unusual double spiral Kin sign. Two glyphs reading "6 Ahau end of a Tun" also intervene. These doubtlessly refer to the contemporaneous Hotun ending.

On Stelae F and D, as shown, the presence of a Cycle 13 indicated a correction of the calendar from this date as opposed to the 7.6.0.0.0 base. Here on Stela C the Cycle 13 date is written out in full.

Since Cycle 13, 3,888 years have come and gone, and a correction of 204 days is necessary at the rate of 24 a century, which is the approximate intercalation used on Stelae F and D with Cycle 13 dates. In the case of the date on Stela D, the correction was running two less for the total than 24 a century, so we should expect the correction to be one of 202 days, for 932 less 730 (two completed years) is 202. At that rate the calculation was 8 Cumhu+202=5 Yax, and the answer is, 5 Yax is the anniversary of the original 8 Cumhu recorded as an Initial Series. As has been noted, there is an addition of 8 days to reach 13 Yax. I believe that this was a correction based on a more accurate knowledge of the length of the solar year. Gregorian would require a correction here of 213 days; by the new calculation the correction is 210 days. Copan would have calculated it as 14 Yax, using a 211-day correction. Let us tabulate these finds:

Base	Rate of calculation	Number of days	Position reached
8 Cumhu	24 a century	204	7 Yax
	Quirigua old calculation	202	5 Yax
	Gregorian	213	16 Yax
	Quirigua new calculation	210	13 Yax
	Copan method	211	14 Yax

This seems fairly straightforward, but why is the 9.1.0.0.0, 6 Ahau 13 Yaxkin date brought into the discussion? This date is 3,568 years from Cycle 13, which by Gregorian calendar would require a correction of 136 days (866 − 730), but our last calculation showed the reformed Quirigua calculations running three days less than Gregorian. Here, then, the correction would be 133 days. This exactly covers the interval between 0 Pop and 13 Yaxkin, the month position of 9.1.0.0.0.

In other words, by their new calculations they found that the date 9.1.0.0.0 was not only a Katun ending, but also the anniversary of the original location of 0 Pop at Cycle 13. Furthermore, this date is particularly appropriate for this monument, since the current Hotun day is also 6 Ahau and the corresponding month coefficient in both cases is 13. There seems little doubt that the Mayas were ever seeking to link dates with the same day and coefficient and same month coefficient. This is particularly the case at Quirigua where the day of the current Hotun is often repeated, a case in point being the 7 Ahau 3 Pop date of Stela D, the date of which is 7 Ahau 18 Pop (p. 378). It is as though these ancient astronomers—astrologers perhaps we should call them—were forever dicing the days in search of a magic formula to capture the future and guide her footsteps along the path of happiness.

STELA A

This monument, the sister of Stela C, also commemorates the Hotun 9.17.5.0.0, 6 Ahau 13 Kayab. This time the date is linked with 6 Ahau 13 Chen. Again we have the recurrence of the same day and coefficient and the same month coefficient, like choristers in alternate chants, stone *cantores et decani*.

In view of the calculations on Stela C one might suppose that this date also records a determinant of 8 Cumhu at Cycle 13. The nearest occurrence of this date before the current Hotun is at 9.14.15.16.0, 6 Ahau 13 Chen. This date is 3,840 years after Cycle 13, and at the old rate of 24 days a century a correction of 192 days would be required. We have seen, however, that at Quirigua corrections were running about two or three days less than this, so a correction of about 190 days will be required: 8 Cumhu + 190 = 13 Chen. Of course, this date is open to doubt because its position is not given in the Long Count, but the general Maya custom was to place such dates before the current Hotun. The Calendar Round is

preceded by a grotesque head above a Tun sign, and with a coefficient of 19 to the left. The meaning of this is unknown.

The next monument dedicated at Quirigua was Altar B erected at 9.17.10.0.0, 12 Ahau 8 Pax. It is too weathered to yield anything more than the Initial Series.

ALTAR G

Altar G, the next monument erected, commemorated the Hotun ending 9.17.15.0.0, 5 Ahau 3 Muan. The inscription is rather worn, but as will be seen, it gives a summary of Quirigua information on the length of the tropical year. The framework of the inscription seems to be as follows:

9.17.15. 0. 0,	5 Ahau 3 Muan
(9.17.14.13. 3,	12 Akbal 6 Yax)
3. 1. 8. 6	Subtract
9.14.13. 4.17,	12 Caban 5 Kayab
(9.17.15. 0. 0,	5 Ahau 3 Muan)
2. 8. 3.14	Subtract (this is very worn)
9.15. 6.14. 6,	6 Cimi 4 Tzec
(9.17.15. 0. 0,	5 Ahau 3 Muan)
4.18	Subtract
9.17.14.13. 2,	11 Ik 5 Yax
9.17.14.13. 0,	9 Ahau 3 Yax
9.17.14.13. 2,	11 Ik 5 Yax
9.17.14.13.12,	8 Eb 15 Yax
4. 8	Add
9.17.15. 0. 0,	5 Ahau 3 Muan, end of Hotun
9.17.14.13. 2,	11 Ik 5 Yax
(9.17.15. 0. 0,	5 Ahau 3 Muan)
2. 5. 0. 0	Add
10. 0. 0. 0. 0,	7 Ahau 18 Zip, end of Cycle 10
(9.17.14.13. 2,	11 Ik 5 Yax)
3.16	Add
9.17.14.16.18,	9 Eznab 1 Kankin, end of Cycle 10
1. 2	Add
9.17.15. 0. 0,	5 Ahau 3 Muan

Some of these figures vary a little from Maudslay's drawings, but the inscription, as stated above, is very worn in places, and it is often impossible to say how many bars a coefficient has. Following Maudslay's drawings literally, one gets nowhere.

Now let us analyze the inscription. First we get our old friends, the determinants 12 Caban 5 Kayab and 6 Cimi 4 Tzec, possibly placed here as antiquarian exhibits in contrast to the more modern calculations to follow. This is in accordance with Maya practice,

for we find the same methods followed in different cities to mark the change from the old independent to the uniform lunar count, as though to say, "This is what we used to think, here is what we now calculate." Next follows 9.17.14.13.2, 11 Ik 5 Yax, followed by 3 Yax and 15 Yax. At the date this monument was erected 3,898 years had whiled since 13.0.0.0.0, 4 Ahau 8 Cumhu. At the rate of 24 days of correction a century, 205 days (935−730) must be added, but we have seen that these Quirigua calculations were running about two or three days less, so the correction must be about 202 days. Then 8 Cumhu+202=5 Yax. Strict Gregorian calls for a correction of 214 days, but the new Quirigua calculations were running about three days less than this, so we should expect an addition according to the new system of about 211 days: 8 Cumhu+210=15 Yax, a date that is associated with 5 Yax as the uncorrected and corrected calculations were juxtaposed on Stela C. I do not know why the 3 Yax date is interposed. It may represent an earlier calculation than the 5 Yax date.

The monument also records 7 Ahau 18 Zip the end of Cycle 10, and there is another Calendar Round date, 9 Eznab 1 Kankin, followed a little lower by a glyph reading, "End of Cycle 10" (Fig. 22, *c*). Of course, this date does not end Cycle 10, but the implication is that it is a determinant for the end of Cycle 10. The date is associated, too, with the 5 Yax date as though to suggest that it is based on the same calculation, as indeed it is. Adding 203 days to 18 Zip, we reach 1 Kankin. Why the formula was changed from 202 to 203 days I do not know, although, of course, the 18 Zip calculation was probably made from the following Tun. Having found this clear determinant of Cycle 10, stamped as a determinant by the addition of the glyph "End of Cycle 10," one is prepared to accept Teeple's suggestion that the 19 Muan date on Stela E (p. 376) is also a determinant of Cycle 10.

Altar O is badly weathered, and only the Initial Series 9.18.0.0.0, 11 Ahau 13 Mac can be recovered. As already stated, this Katun ending is commemorated by more monuments than any other single date in the Maya calendar, probably because it repeats the original 11 Ahau of 7.6.0.0.0.

ALTAR M

All the zoomorphic altars at Quirigua that register Hotuns were erected between 9.17.10.0.0 and 9.18.5.0.0, and for this reason one can assume that Zoomorph M belongs to this same period, although the date it carries is from fifty to sixty years earlier. Parallel cases

occur at Copan of stelae erected at about this same date carrying earlier dates, in fact, in one instance, the same date as Altar M. The inscription on Altar M reads:

(9.15.0.0.0) 4 Ahau 13 Yax
3.2.0 Add

(9.15.3.2.0) 6 Ahau 18 Zac

If we are correct in our assumption that this monument was erected in the period covered by the other zoomorphic altars, one would suppose that the determinant would be based on the new calculations approximating Gregorian. The date appears to be a determinant of 8 Cumhu at 7.6.0.0.0. Between these two dates 969 years have elapsed, calling for a correction of 235 days by strict Gregorian: 8 Cumhu+235=18 Zac. The calculation is the most accurate we have yet seen.

ALTAR P

Altar P commemorates with an Initial Series the Hotun 9.18.5.0.0, 4 Ahau 13 Ceh. The inscription, unfortunately, is very badly weathered. Determinants seem to be dealt with, for we find a reference to Cycle 13 in D19. The 13 Tun glyph and the number 18 in association with the glyph of the long-nosed manikin god possibly indicate that the Initial Series is an even number of the 13 Tun=18 Tonalamatl period from the original 4 Ahau 8 Cumhu date of Cycle 13. Actually the Hotun 9.18.5.0.0 is itself a determinant of 8 Cumhu at 7.6.0.0.0 by strict Gregorian. On Altar M we saw how 18 Zac was the determinant of 8 Cumhu at 9.15.3.2.0. The date of this monument is 61 years later, so we add 15 days to cover the leap days in this period, and reach 13 Ceh: 8 Cumhu+250= 13 Ceh.

There are three other dates that can be read, but no apparent connecting numbers. These are 6 (?) 18 Yax, possibly 9.18.2.15.5, 6 Chicchan 18 Yax, 8 Ahau 18 Yaxkin, which is probably 9.17.19.12.0 and 9 Ahau 3 Zotz, which is declared, apparently, to end a Tun 7. The 6 Chicchan 18 Yax date appears to be a determinant of 8 Cumhu at Cycle 13. The distance is 3,905 years, requiring a correction of 216¼ days by a strictly Gregorian reckoning. The calculation here is: 8 Cumhu+215=18 Yax. This follows the other cases where the Maya calculation runs from two to three days under Gregorian. The 8 Ahau 18 Yaxkin also appears to be a determinant of 8 Cumhu, but in the reverse direction. The calculation is based on the old 24-day a century correction. Perhaps the Maya astronomers

were not certain which system was right, and gave both. The date is some three years earlier, so the Gregorian intercalation would be 215½, and at 24 days a century 206½ days: 18 Yaxkin+210=8 Cumhu. This is a slight improvement on the old 24-day a century calculation.

The 9 Ahau 3 Zotz date, when placed at 9.18.10.11.0, becomes a determinant of 9.18.10.0.0, 10 Ahau 8 Zac. A total of 3,913 years has passed since Cycle 13, requiring a correction by Gregorian of 218 days: 8 Zac+220=3 Zotz. The possible 7 Tun glyph is weathered, and the suggested reading may well be wrong. There is also a reference to 9.15.0.0.0, 4 Ahau 13 Yax, possibly because it also falls on 4 Ahau and the month coefficient is the same. What we can make out of the inscription would suggest as follows: "9.18.15.0.0, 4 Ahau 13 Ceh is the date this monument commemorates. This day is not only a Hotun ending, but also the anniversary of 8 Cumhu at 7.6.0.0.0. The anniversary of 8 Cumhu at 13.0.0.0.0, however, has advanced to 18 Yax, and, conversely, by our old system of calculation the position now occupied by 8 Cumhu was occupied at 13.0.0.0.0 by 18 Yaxkin. Also the Hotun day is 4 Ahau, the anniversary of the mythical start of our calendar, the distance between being an exact number of the 13 Tun=18 Tonalamatl period. This same condition also occurred at 9.15.0.0.0, 4 Ahau 13 Yax, and that date, of course, not only had the same day and coefficient, but also had the same month coefficient. 8 Zac, which ends the current Lahuntun, will have advanced since Cycle 13, 220 days in the year to 3 Zotz."

There is a great deal more in the inscription of which we have no inkling, but the date was clearly of very great importance to the Mayas, and the monument recording these dates is the most elaborate and beautiful erected at Quirigua. The day 4 Ahau had been repeated exactly 5,490 times since Cycle 13.

STELA I

The next Hotun, 9.18.10.0.0, 10 Ahau 8 Zac, was commemorated by a stela instead of a zoomorphic altar such as marked the four previous Hotuns. Following the Initial Series is given the Hotun date 9.15.5.0.0, 10 Ahau 8 Chen in accordance with Quirigua custom of ringing the chimes on dates with the same day and coefficient. This is followed by the date 9.15.6.14.0, 13 Ahau 18 Zotz. This is just six days before our old friend 9.15.6.14.6, 6 Cimi 4 Tzec, which, it will be remembered, was the determinant of 9.14.15.0.0, 11 Ahau 18 Zac. The explanation I am going to give below may

sound far-fetched, but it is the kind of juggling with dates that I believe most interested the Mayas. I would hazard that their train of thought was somewhat as follows:

"The last monument we erected showed that the current Hotun day 8 Zac occupied the position at Cycle 13 now occupied by 3 Zotz. This was based on our new reformed calculations. For years we used 6 Cimi 4 Tzec as a determinant of 9.14.15.0.0, 11 Ahau 18 Zac with a 7.6.0.0.0 basis. We are now dealing not with 18 Zac, but 8 Zac. At that time we should have written 14 Zotz as the determinant of 8 Zac, for this is ten days less. We are now making the calculation eleven years later, so we shall have to add two or nearly three days for the leap years of this period, which will bring the date to 16 or 17 Zotz, but we also now know that our early calculations were in error; we calculated 24-day correction a century. It should have been 97 days for four centuries. The interval is over 900 years, so we must add another couple of days. This brings us to 18 Zotz."

Gregorian would have made this calculation 19 Zotz. The Maya calculation is slightly better than the Gregorian.

STELA K

The next Hotun, 9.18.15.0.0, 3 Ahau 3 Yax, is commemorated by Stela K. There is a subtraction of 10.10 leading to 1 Oc 18 Kayab duly recorded.

This is apparently a determinant of 3 Yax, for 18 Kayab at Cycle 13 occupied the position in the solar year now occupied by 3 Yax. The equation is: 18 Kayab $+210=3$ Yax. The correction is based on 24 days a century. Since Cycle 13, 3,918 years have whiled, requiring a correction of 210½ days at this rate. Gregorian would call for about 220.

We are back at the old 24-day a century correction. The fundamentalists seem to have won, and the new calculations are rejected. Let us try to envisage the circumstances of this change.

Maya history suffers from intangibility. Our background is not peopled by a thousand legends. No Diana confronts the Maya worker, and no faun peeps out at us from classic copse. In Europe history fades imperceptibly into legend, and the ploughman of the Shropshire loams is not quite out of touch with Ceres. In the New World the transition is far greater materially and spiritually. It is difficult to step into the past of another race with a different climate and a non-material civilization. Still, for an appreciation

of Maya civilization it is essential to quicken the monuments into some life, and not to treat them as well-executed sculptures or serried Ahaus, Zips, and Yaxes. Lacking a Vergil we must try ourselves to bring back the atmosphere, even if a touch of modernity does creep in.

Probably there existed some gild of astronomer-priests in every city, one of the duties of which was to plan the inscriptions to be carved on the stelae and altars. To expect unanimity in such a group would be contrary to experience. Factions and groups must have existed then as in any similar committee of the present time. We might visualize two groups struggling for control, one section favoring the approximately Gregorian reckoning, the more conservative adhering to the old 24-day a century formula.

Control of the astronomers' gild was probably not the reward of ability, but of birth and seniority, for the modern Maya shows a marked respect for age. It would be natural to find progress sometimes giving way to reaction, as we see on these last monuments at Quirigua. The Gregorian theory may have been advanced by an intellectual group temporarily in control, but these Galileos were before their time, their theories were only half accepted, and, by the time Stela K was erected, the conservative element had regained control and the 24-day a century correction came into sole use once more.

Quirigua, too, was probably not immune to the back-slapping socially minded scientist, who, with no particular ability, makes his way to the top by assiduous cultivation of the right people. The type is common enough in modern scientific associations; one may presume that it also existed in ancient Quirigua. Perhaps we may trace the influence of such a chairman of the astronomers' gild in the next inscription at Quirigua (Structure 1). Those inscriptions where redundancy occurs, but no extra information appears to be given, might be from the hand of some mental glyptodont carried by seniority to a position of supreme authority. The kind of thing I mean is where a Hotun is registered as an Initial Series, and then the date is repeated at the end with the information that it is a Hotun ending. This is pure tautology.

A feeling of local patriotism may also have had something to do with the return to favor of the 24-day a century formula. The Gregorian may have savored too much of Copan. We know that Quirigua had her own ideas of the lunar count at about this time, contradicting every other Maya city on the age of the moon. She

may also have shown her independence by returning to this different computation of the length of the solar year.

STRUCTURE 1

This temple carries the last contemporaneous date found at Quirigua, the Katun ending 9.19.0.0.0, 9 Ahau 18 Mol. There is a date recorded by a subtraction of 2 Uinals 9.18.19.16.0, 8 Ahau 18 Xul. This does not appear to be a determinant. The last glyphs, apparently, refer to the end of Cycle 10, one Katun hence.

A DETERMINANT GLYPH

Doctor Teeple (p. 85) remarks that the hand with peculiar figure above (Fig. 22, *a*) seems to be used sometimes at Quirigua as a determinant glyph. H. J. Spinden (Fig. 47) shows a series of glyphs, illustrating how the glyph, to which Teeple calls attention, is nothing more than the peculiar concave forehead of a god, whose glyph is frequently found in the inscriptions (Fig. 22, *c*). Spinden believes that this glyph represents the long-nosed god of rain as patron of the era of the chronicles, that is, Cycle 9, the summer solstice and the rainy season.

I think there is no doubt Spinden is correct in stating that this deity is a rain god, but I do not believe it is connected with the current Cycle 9. Two scrolls invariably issue from the forehead. The large presentation of the gods on the stalk of a maize plant on the Tablet of the Foliated Cross at Palenque (Fig. 23, *h*) shows clearly that these scrolls represent maize leaves. Sometimes a small stone ax is inserted in the forehead, for this object is the symbol of these fertility gods in their role of thunder-makers. Full-figure glyphs of this god are found as possible determinant indicators at Palenque. These appear to demonstrate a connection with the god of the manikin scepter, for the appendage scroll is clearly visible (Fig. 23, *e–g*). Sometimes a coefficient of nine is attached to the glyph, and this might indicate Bolon Tzacab, a god of agriculture referred to in the Chilam Balam of Chumayel. He figures in the story of the creation, possibly in connection with the start of the Long Count (Martinez, p. 170). As a rain and fertility god, he may have come to represent the year, since another Maya name for the Tun was Haab, a word carrying the root of the word for rain, and the alternative glyph for the Tun sign is the winged Cauac, which also carries the idea of rain. His glyph may have come to

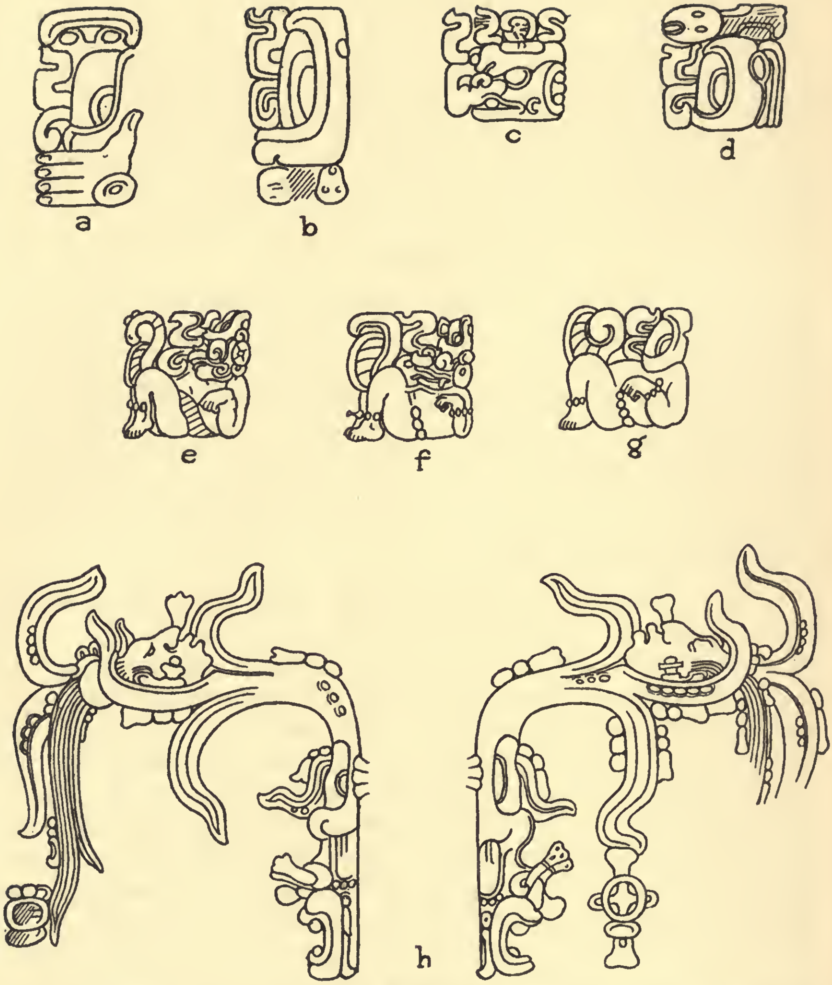

Fig. 23

The Long-nosed Rain God: *a–g*, as a Determinant Glyph; *h*, as the Stalk of Maize Plant, Temple of Foliated Cross, Palenque.

be used as a determinant glyph to show the advance of the rainy season, that is the year, over the 365-day year.

In Appendix I are listed all the occurrences of this glyph with legible dates at Quirigua, Copan and Palenque. Practically all the dates are possible determinants, or dates where the sun is at the solstice, the equinox or the zenith in the Goodman-Thompson correlation. The glyph, however, is not found with every determinant. Its presence or absence probably depended on the loquacity of the author or the exigencies of space. As such an overwhelming number of non-Tun-ending dates are clearly determinants, possibly the association of this glyph is purely fortuitous. The evidence, while indicating its use as a determinant indicator, is not conclusive.

SUMMARY

We have passed the Quirigua dates in review, noting how greater accuracy gradually developed, and how a reverse took place, the poorer formula coming into vogue again. We have condensed into a few pages the intellectual advance of a century. At the height of Quirigua's development we find the length of the solar year calculated over a period of almost 4,000 years with even greater accuracy than that achieved by our own Gregorian calendar. This is no mean achievement for a primitive people with no instruments of precision, but a boundless fund of patience. One tries to picture the thousands of dawns that were observed before such accuracy was attained, the clouded days that must have provided countless disappointments, the hot drowsy nights of vigil, then the dawn breeze coming across from the Bay of Honduras as the watcher made his observations; or again at midday the overhead sun beating down as the priest watched its approach to the zenith.

It is hard to clothe the stelae with personality. I feel convinced that no civil events were ever recorded on them, merely computations of determinants, a few direct astronomical observations, and records of the appropriate religious ceremonies. From Silan to Quen Santo, the Maya Dan to Beersheba, stelae and altars were erected. The framework was the same in every city. If the date were 9.15.0.0.0, the day must be 4 Ahau, the month position 13 Yax, the god of the month the planet Venus, and the lord of the night the sun god. These, combined with the Lunar Series, form, so far as our present knowledge goes, the highest common factor of inscriptions of the same date. Glyphs recording ritualistic information such as world direction rulers and rulers of the weeks should eventually be isolated.

The remaining glyphs, among which those connected with determinants bulk large, will eventually permit of a classification of the various cities by their scientific achievements, and will at the same time give some insight into the history of individual cities. No names of rulers will be forthcoming, but it should be possible to trace the progressive or reactionary tendencies of the chairmen of the astronomers' gilds in the various calculations of determinants. Quirigua's advance from a 24-day a century correction to an approximately Gregorian reckoning has already been noted, and with this progress a brief space when the Quirigua calculations were actually superior to Gregorian, and two periods of reaction. Doubtlessly the determinants of other cities will yield similar information.

An examination of Quirigua dates reveals that a number of determinants were calculated from a 7.6.0.0.0 base. A casual survey of determinants at other cities shows that this practice was in vogue over a wide area. There is certain information, unfortunately far from conclusive, pointing to the formal inauguration of the Maya count at this date. This was a conclusion reached by Teeple shortly before his death. Sometimes the calculations were made from the mythical start of the calendar at 13.0.0.0.0, 4 Ahau 8 Cumhu, at other times the calculation was based on 7.6.0.0.0, 11 Ahau 8 Cumhu. At a much earlier period, when a Julian reckoning was used, it did not matter which base was used since both gave the same results by this reckoning; but with a Gregorian calculation a difference of thirty-two days appears, hence the necessity of deciding between the two bases. Most cities seem to have used both bases at an early period, but gradually the 13.0.0.0.0 reckoning supplanted the 7.6.0.0.0 count at most Maya cities.

One wonders why the cumbersome Initial Series was employed. Once the Calendar Round date and the lord of the night is known, that date is fixed in a period of some 465 years. It cannot be repeated in that interval, and such a combination would only have occurred four times since the beginning of the Christian Era. Why then was the Initial Series written out in full? In the answer I am going to suggest, I believe we have a slight insight into Maya psychology. Can it not be that the Initial Series was written in full to create a spirit of eternity and express the grandeur of time? After all, the Mayas disagreed with Archbishop Ussher many centuries before Darwin.

On page 391 are listed in tabular form the different or apparent determinants recorded at Quirigua. In this form it is possible to trace the growing accuracy of the Quirigua astronomers.

Table of Quirigua Determinants

Monument	Erected at	Determined	Determinant	Cycle base	Month position Then	Month position Now	Years elapsed	Maya	Correction Gregorian	At 24 days per century
J	9.16.5.0.0 8 Ahau 8 Zotz	Katun 15 13 Yax	9.14.13.4.17 12 Caban 5 Kayab	7.6	5 Kayab	13 Yax	966	233	—	232½
		Katun 14¾ 18 Zac	9.15.6.14.6 6 Cimi 4 Tzec	7.6	18 Zac	4 Tzec	961	231	—	231
F	9.16.10.0.0 1 Ahau 3 Zip	Katun 17 18 Cumhu	9.16.5.7.0 1 Oc 13 Yax	13.0	18 Cumhu	13 Yax	3,871	200	—	199¾
D	9.16.15.0.0 7 Ahau 18 Pop	Current 0 Pop	9.16.13.4.17 8 Caban 5 Yaxkin	7.6	5 Yaxkin	0 Pop	999	240	—	240
		Katun 15 13 Yax	9.14.17.8.0 7 Ahau 3 Pop	13.0	3 Pop	13 Yax	3,841	190	—	192
E	9.17.0.0.0 13 Ahau 18 Cumhu	Cycle 10 18 Zip	9.16.11.13.1 11 Imix 19 Muan	7.6	18 Zip	19 Muan	997	241	241	—
C	9.17.5.0.0 6 Ahau 13 Kayab	Cycle 13 8 Cumhu	9.17.4.10.12 1 Eb 5 Yax	13.0	8 Cumhu	5 Yax	3,888	202	—	204
		Cycle 13 8 Cumhu	9.17.4.11.0 9 Ahau 13 Yax	13.0	8 Cumhu	13 Yax	3,888	210	213	—
		Cycle 13 0 Pop	9.1.0.0.0 6 Ahau 13 Yaxkin	13.0	0 Pop	13 Yaxkin	3,568	133	136	—
A	9.17.5.0.0 6 Ahau 13 Kayab	Cycle 13 8 Cumhu	9.14.15.16.0 6 Ahau 13 Chen	13.0	8 Cumhu	13 Chen	3,839	190	—	192
G	9.17.15.0.0 5 Ahau 3 Muan	Cycle 13 8 Cumhu	9.17.14.13.2 11 Ik 5 Yax	13.0	8 Cumhu	5 Yax	3,898	202	—	206
		Cycle 13 8 Cumhu	9.17.14.13.12 8 Eb 15 Yax	13.0	8 Cumhu	15 Yax	3,898	212	215	—
		Cycle 10 18 Zip	9.17.14.16.18 9 Eznab 1 Kankin	13.0	18 Zip	1 Kankin	3,898	203	—	206
M	About 9.18.0.0.0 11 Ahau 18 Mac	7.6.0.0.0 8 Cumhu	9.15.3.2.0 6 Ahau 18 Zac	7.6	8 Cumhu	18 Zac	969	235	235	—
P	9.18.5.0.0 4 Ahau 13 Ceh	7.6.0.0.0 8 Cumhu	9.18.5.0.0 4 Ahau 13 Ceh	7.6	8 Cumhu	13 Ceh	1,030	250	250	—
		Cycle 13 8 Cumhu	9.18.2.15.5 6 Chicchan 18 Yax	13.0	8 Cumhu	18 Yax	3,905	215	216	—
		Current 8 Cumhu	9.17.19.12.0 8 Ahau 18 Yaxkin	13.0	18 Yaxkin	8 Cumhu	3,902	210	—	206½
		Katun 18½ 8 Zac	9.18.10.11.0 9 Ahau 3 Zotz	13.0	8 Zac	3 Zotz	3,913	220	218	—
I	9.18.10.0.0 10 Ahau 8 Zac		9.15.6.14.0 13 Ahau 18 Zotz	7.6	8 Zac	18 Zotz	973	235	236	—
K	9.18.15.0.0 3 Ahau 3 Yax	Katun 18¾ 3 Yax	9.18.14.7.10 1 Oc 18 Kayab	13.0	18 Kayab	3 Yax	3,918	210	—	210½

TEMPLE OF THE INSCRIPTIONS, PALENQUE

In contrast to Quirigua, Palenque had achieved a remarkable accuracy in determining the length of the tropical year several decades before Quirigua rose to any importance as an epigraphic center. It is not proposed to discuss the inscriptions at Palenque one by one, but to present a sample of the best results attained. Many of the Palenque texts are obscure owing to the drastic suppression of dates. The clearest text of considerable length is that which was formerly housed in the Temple of the Inscriptions. This, possibly the latest known inscription at this site, clearly demonstrates the superiority of the best Palenque calculations over those of Quirigua.

The elucidation of the text in question has been attempted by several writers. A contribution of outstanding importance was that made by R. C. E. Long. He was the first to identify the Great Cycle glyph in this inscription, proving by calculation the value previously assumed for it on positional evidence, and thereby showing that the Great Cycle, here at least, had a value of twenty Cycles. However, I do not accept his and Morley's identifications of E12 as 7 Cabaltuns. The superfix is surely the ordinary ending sign of a hand with doubled fingers and ornament. Indeed, I feel sceptical of all supposed examples of the Cabaltun glyph.

Teeple, in his discussion of the determinant theory, pointed out the purpose of some of the dates listed below, and Spinden was the first to put forward a connected reading of the whole inscription.

It is to be hoped that excavations will be initiated at Palenque in the near future. This site holds out great hopes of a rich epigraphic yield, for it is reasonably certain that other panel inscriptions will eventually be found in collapsed buildings.

The three panels of the Temple of the Inscriptions at Palenque, consisting of 620 glyph blocks, form the longest intact Maya hieroglyphic record at present known. About one-third of the first (east) panel is obliterated, but the rest of the inscription is remarkably well preserved.

Below is given an interpretation of such parts of the record as can be read. In a number of vital points, this reading differs from any other so far published. These differences will be discussed in the text. The attached dates in our own calendar are based on the Goodman-Thompson correlation.

EAST PANEL

A1-A6	9. 4. 0. 0. 0,	13 Ahau 18 Yax	Oct. 16	I.S.
A10-B10	11.10. 3			Subtract
	9. 3. 8. 7.17,	10 Caban (10 Zip)	May 25	Determinant
F4-E5	9. 6. 0. 0. 0,	9 Ahau 3 Uayeb	Mar. 21	Equinox
J5-I6	9. 7. 0. 0. 0,	7 Ahau 3 Kankin	Dec. 7	
I10-J10	9. 7. 5. 0. 0,	13 Ahau 18 Ceh	Nov. 11	P.E.
	(9. 7.10. 3. 8,	9 Lamat 1 Muan)	Dec. 22	Solstice
K2-K3	9.14.12			Add
K6-L6	9. 8. 0. 0. 0,	5 Ahau 3 Chen	Aug. 24	
L9-K10	1. 8.10			Add
	(9. 8. 1. 8.10,	2 Oc 8 Kayab)	Feb. 5	Determinant
N1-N2	9. 8.13. 0. 0,	5 Ahau 18 Tzec	June 16	P.E.
M7-N7	9. 8.17. 9. 0,	13 Ahau 18 Mac	Nov. 21	Determinant
M[illegible]-N6	6.14			Add
M9-N9	9. 8.17.15.14,	4 Ix 7 Uo	April 4	
	(9. 8.19.15.10,	5 Oc 13 Pop)	Mar. 22	Equinox
N19	2.10			Add
P2-P3	9. 9. 0. 0. 0,	3 Ahau 3 Zotz	May 11	P.E.
	(9. 9. 2. 4. 8,	5 Lamat 1 Mol)	July 28	Determinant
R9-Q10	17.13.12			Add
S1-S3	9.10. 0. 0. 0,	1 Ahau 8 Kayab	Jan. 26	P.E.

CENTRAL PANEL

A2-A3	9.11. 0. 0. 0,	12 Ahau 8 Ceh	Oct. 13	P.E.
G1-G2	9.12. 0. 0. 0,	10 Ahau 8 Yaxkin	June 30	P.E.

WEST PANEL

B8-A9	9.12. 0. 0. 0,	10 Ahau 8 Yaxkin	June 30	
C1-D1	9.13. 0. 0. 0,	8 Ahau 8 Uo	Mar. 17	
C7-D7	10. 0. 0. 0. 0,	7 Ahau 18 Zip	Mar. 15	
D9	5			Add
	(10. 0. 0. 0. 5,	12 Chicchan 3 Zotz)	Mar. 20	Equinox
C11-C12	1. 0. 0. 0. 0. 0,	10 Ahau 13 Yaxkin	Oct. 14	P.E.
E3-F3	9. 8. 9.13. 0,	8 Ahau 13 Pop	Mar. 25	Determinant
E1-F1	12. 9. 8			Add
E6-F6	9. 9. 2. 4. 8,	5 Lamat 1 Mol	July 28	Determinant
E7-F7	2. 4. 8			Subtract
E8-E9	9. 9. 0. 0. 0,	3 Ahau 3 Zotz	May 12	P.E.
F9-E11	2. 9. 1.12. 0			Subtract
	(6.19.18. 6. 0,	8 Ahau 8 Cumhu)	Oct. 13	Determinant
E12	End of Cycle 7	Above determinant of		
H1-G2		1 Manik 10 Tzec		
	(9. 8. 9.13. 0,	8 Ahau 13 Pop)	Mar. 25	Determinant
G4-H5	10.11.10. 5. 8			Add
H6-G7	1. 0. 0. 0. 0. 8,	5 Lamat 1 Mol	Oct. 22	
G8	8			
G9-H9	1. 0. 0. 0. 0. 0,	10 Ahau 13 Yaxkin	Oct. 14	P.E.
H10	1. 0. 0. 0. 0. 8,	5 Lamat 1 Mol	Oct. 22	

CENTRAL PANEL—*Continued*

G11-H11	(19.19. 5.10. 7)	4 Manik 10 Zip	July 26	Determinant
L8	9.11. 0. 0. 0,	12 Ahau (8 Ceh)	Oct. 13	
L7-L8	6.16.17			Add
K11-L11	9.11. 6.16.17,	13 Caban 10 Chen	Aug. 15	Determinant
P3-P4	9.11. 0. 0. 0,	12 Ahau 8 Ceh	Oct. 13	P.E.
P5-O6	9.12. 0. 0. 0,	10 Ahau (8 Yaxkin)	June 30	P.E.
O5-P5	3. 6. 6			Add
O7	9.12. 3. 6. 6,	7 Cimi 19 Ceh	Oct. 19	Determinant
P7-P8	9. 7.11. 3. 0			Subtract
O12-P12	13. 4.12. 3. 6,	1 Cimi 19 Pax	June 22	Solstice
R1	9.12. 3. 6. 6,	7 Cimi 19 Ceh	Oct. 19	Determinant
R3-Q4	9. 9.13. 0. 0,	3 Ahau 3 Uayeb	Mar. 4	
Q3	17			Add
Q6-R6	9. 9.13. 0.17,	7 Caban 15 Pop	Mar. 21	Equinox
Q7-Q8	2. 7. 6. 1			Add
Q11	9.12. 0. 6.18,	5 Eznab 6 Kankin	Nov. 14	Determinant
R11-Q12	9.11. 2			Add
S1-T1	9.12.10. 0. 0,	9 Ahau 18 Zotz	May 9	P.E.
	(1. 4.10)			Add
S3	9.12.11. 4.10,	4 Oc (3 Chen)	Aug. 3	Sun at zenith
S4	1. 8			Add
T5	9.12.11. 5.18,	6 Eznab 11 Yax	Aug. 31	Determinant
T6-S7	4. 1.10.18			Subtract
	9. 8. 9.13. 0,	(8 Ahau 13 Pop)	Mar. 25	Determinant
T8	(9.12.11.12.10)	8 Oc 3 Kayab	Jan. 10	Determinant

As in a few other inscriptions, the Initial Series that opens the calculations is projected a considerable distance into the past. The greatest emphasis, however, is laid on the date 9.11.0.0.0, 12 Ahau 8 Ceh, around which, as will be shown, the calculations revolve. The actual date which the monument commemorates may be 9.12.10.0.0 or even 9.13.0.0.0, but little attention is paid to these dates in the text, and it may be that they, like others in the text, are prophetic.

The fact that 9.11.0.0.0, 12 Ahau 8 Ceh is the most important date in the inscription gives the clue to the choice of 9.4.0.0.0 as the Initial Series to open the inscription. After the lapse of seven Katuns a position in the solar year is reached within four days of the date at which the calculation opened. The calculation is: 7 Katuns = 50,400 days; 138 Gregorian years = 50,403.46 days. Thus 9.4.0.0.0, 13 Ahau 18 Yax was chosen to open the inscription because it is exactly seven Katuns before the great date 9.11.0.0.0, and was, therefore, only some three days later in the tropical year

(October 13 and October 16 respectively in the Goodman-Thompson correlation). Two other examples of the use of this seven-Katun interval will be found in the text.

There is a second very important reason why 9.4.0.0.0, 13 Ahau 18 Yax was of outstanding importance. It is a determinant of 8 Cumhu, for 18 Yax at Cycle 13 occupied the position in the tropical year occupied at 9.4.0.0.0 by 8 Cumhu. The interval is 3,627 years, requiring a Gregorian correction of 149¾ days. The calculation is: 18 Yax+150=8 Cumhu.

The discovery that 9.4.0.0.0, 13 Ahau 18 Yax was a determinant of 8 Cumhu must have been of transcendental importance to the astronomers, since Katun endings would very rarely prove to be also determinants. The combination of a Katun ending that was not only a determinant of 8 Cumhu but also occupied practically the same position in the tropical year as the date, seven Katuns later, which was the center of calculations must have enhanced its value a hundredfold.

Following the Initial Series there is a Secondary Series, recorded at A10-B10, of 11.10.3, although the Tun coefficient might also be either 12 or 13. The glyph shown in A12 is pretty clearly Caban. The cartouche, three pedestal support and Cauac infix are present, the last feature being typical of Caban glyphs at Palenque. The coefficient, however, is badly eroded. It appears to record some number between six and ten, with the latter the most probable. Subtracting the Secondary Series of 11.10.3 from the Initial Series, the date 9.3.8.7.17, 10 Caban 10 Zip is reached. From its association, one would expect this date to be a determinant of the Initial Series, and so it proves to be. At 9.3.8.7.17 a total of 3,615 years has passed since 13.0.0.0.0, 4 Ahau 8 Cumhu, requiring a Gregorian correction of 147 days. The calculation is: 10 Zip+148=18 Yax. In other words 10 Zip occupied at Cycle 13 the position in the tropical year now occupied by 18 Yax, the current Katun-ending month position.

There follow in succession the period-ending dates 9.5.0.0.0, 9.6.0.0.0, 9.7.0.0.0 and 9.7.5.0.0. The last date is followed by the required Hotun-ending glyph as well as a sign denoting the end of an unknown number of Cycles. This last glyph would suggest, following Quirigua precedent, that 9.7.5.0.0 was the determinant of some Cycle, but as the coefficient is badly weathered, it is impossible to discover what the calculation was.

At K2-K3 there is a Secondary Series of 9.14.12 followed in K6-L6 by 9.8.0.0.0, 5 Ahau 3 Chen. Where a suppressed date is

involved, I have made the assumption that the Secondary Series leads forward from the suppressed date to the Lahuntun date that follows it. Where there is no following Lahuntun date as at L9-K10, I have assumed the Secondary Series leads forward to the suppressed date. This assumption is based on the probability that the suppressed dates are determinants, which in the great majority of cases precede the Lahuntun they determine.

If 9.14.12 leads forward to 9.8.0.0.0, the suppressed date is 9.7.10.3.8, 9 Lamat 1 Muan. This date is not a determinant, but reaches the winter solstice in the Goodman-Thompson correlation.

In L9-K10 there is a Secondary Series of 1.8.10. As the next date is not a Lahuntun ending, this should be subtracted from the suppressed date. The suppressed date is, then, 9.8.1.8.10, 2 Oc, 8 Kayab. This is a determinant of 9.8.0.0.0, 5 Ahau 3 Chen. At this date a Gregorian correction of 168½ days is required to cover the 3,706 years passed since Cycle 13. The calculation is: 3 Chen+165=8 Kayab.

Passing over two period-ending dates, we reach in M7-N7 a Calendar Round date 13 Ahau 18 Mac, which is generally agreed to have occupied the position 9.8.17.9.0, 13 Ahau 18 Mac. This is a determinant for 9.9.0.0.0, 3 Ahau 3 Zotz. A correction of 172¾ days is required by Gregorian. The calculation is: 18 Mac+170=3 Zotz. Thus this determinant resembles that given above in running three days less than Gregorian.

A Secondary Series of 6.14 links the last date with 9.8.17.15.14, 4 Ix 7 Uo recorded at M9-N9. This date is not a determinant, but happens to be an anniversary of the original autumn equinox at Cycle 13 according to the Goodman-Thompson correlation. A Gregorian correction of 173 days is required. The calculation is: April 4+172=September 23. It is, of course, uncertain if the astronomer had this in mind in writing the date even if the proposed correlation is correct. It should be noted, however, that the next date reaches the current spring equinox as though in contrast. N19 carries a Secondary Series of 10.2 or 2.10. On the assumption already made, this is an addition from a suppressed date leading to 9.9.0.0.0, 3 Ahau 3 Zotz recorded at P2-P3. If read as 2 Uinals 10 Kins, the suppressed date is 9.8.19.15.10, 5 Oc 13 Pop. This reaches the position March 22 in the Goodman-Thompson correlation, marking the spring equinox.

At R9-Q10 there is another Secondary Series of 17.13.12. Maudslay's drawing shows the Tun coefficient as 19, but an examina-

tion of the photograph reveals that the coefficient is probably 17. Subtracting the Secondary Series from the Katun ending 9.10.0.0.0, 1 Ahau 8 Kayab recorded at S1-S3, the date 9.9.2.4.8, 5 Lamat 1 Mol is reached. This is one of the most important dates at Palenque, for it is recorded elsewhere in this inscription as well as on the Hieroglyphic Stairway. The date is a determinant of 9.10.0.0.0, 1 Ahau 8 Kayab, reckoned not from the determinant itself, but from the Katun ending. The correction required at 9.10.0.0.0 is 178¼ days. The calculation is: 8 Kayab+178=1 Mol. This determinant has already been pointed out by Teeple.

The last date recorded on the east panel is the 9.10.0.0.0, 1 Ahau 8 Kayab already noted as occurring at S1-S3.

The central panel is at present largely indecipherable. There are recorded the Katun endings 9.11.0.0.0, 12 Ahau 8 Ceh and 9.12.0.0.0, 10 Ahau 8 Yaxkin. Apparently the panel is about equally divided between these two dates, recording information on astronomical and liturgical matters.

The west panel carries the Katun ending 9.12.0.0.0, 10 Ahau 8 Yaxkin as its first date, followed at the head of the second column by the next Katun ending 9.13.0.0.0, 8 Ahau 8 Uo. The seven-Katun interval is again brought in at this point, for the next date recorded is seven Katuns in the future. It is the Cycle-ending date 10.0.0.0.0, 7 Ahau 18 Zip recorded as a Calendar Round at C7-D7. The sequence really starts with 9.6.0.0.0, marking March 21, the spring equinox. Next comes 9.13.0.0.0, reaching the position March 17. This is followed by 10.0.0.0.0 which falls on March 15. Finally in D9 there is a record of 5 Kins. If this is meant to be added to the last recorded date, the count is brought up to March 20, which is within a day of the spring equinox.

From Cycle 10 the count jumps forward another ten Cycles to the date 10 Ahau 13 Yaxkin, recorded in C12 as one Great Cycle. It is, in fact, one Great Cycle from 13.0.0.0.0, 4 Ahau 8 Cumhu. In view of our ignorance as to how Great Cycles were counted, it is best to write this date as 1.0.0.0.0.0, 10 Ahau 13 Yaxkin.

This date repeats the position in the tropical year reached by 9.11.0.0.0, 12 Ahau 8 Ceh with an error of slightly less than a day. The distance is 209 Katuns. Apparently what the Mayas wanted to record was that at the end of thirty times the seven-Katun interval, the cumulative error of 3½ days per seven Katuns could be wiped out by dropping one Katun from the count. After 210 Katuns the error is a trifle under 261 days, but by dropping one Katun this error is

wiped out, since in one Katun the tropical year advances 105 days. The calculation is:

210 Katuns = 1,512,000 days = 4,139 years and 261 days
209 Katuns = 1,504,800 days = 4,120 years and 0.9 days

In other words the Mayas started with 9.11.0.0.0, which reaches October 13 in the Goodman-Thompson correlation. To this they added 209 Katuns and reached the Great Cycle date 1.0.0.0.0.0, 10 Ahau 13 Yaxkin, occupying the position October 14 in the Goodman-Thompson correlation, exactly 4,200 years in the future. No mean achievement.

After this the count goes back to nearly contemporary time. A Secondary Series of 12.3.8, generally considered to be an error for 12.9.8, connects 9.8.9.13.0, 8 Ahau 13 Pop with 9.9.2.4.8, 5 Lamat 1 Mol. The latter date is a determinant (p. 397); of the former date discussion will be temporarily postponed. Another Secondary Series of 2.4.8 subtracted from 9.9.2.4.8 leads to 9.9.0.0.0, 3 Ahau 3 Zotz recorded at E8-E9.

The next Secondary Series, recorded at F9-E11, has caused more stumbling than, possibly, any other date in the Maya inscriptions. This reads either 2.9.1.12.0 or 2.9.1.12.1, the former reading perhaps being preferable, as the dot which has been read as 1 Kin appears to be ornamental. It does not, however, make much difference to the argument whether the dot is read as 1 or 0.

Subtracting 2.9.1.12.0 from the adjacent Katun ending 9.9.0.0.0, the suppressed date 6.19.18.6.0, 8 Ahau 8 Cumhu is reached. The date has a triple significance. It is a determinant of 7.0.0.0.0, ends on the very important month position 8 Cumhu, and occupies within a day the same position in the tropical year as 9.11.0.0.0 and 1.0.0.0.0.0.

Taking up first the question of the determinant, we note that E12 actually reads "End of Cycle 7." The date in question, of course, does not end Cycle 7, but examples of this type of determinant recording have already been noted at Quirigua and Piedras Negras. The determinant is reckoned from 9.9.0.0.0, from which the calculation started. The interval is 967 years, requiring a Gregorian correction of 234¾ days. The calculation is 8 Cumhu + 235 = 18 Zac. In other words 8 Cumhu at 7.0.0.0.0 occupied the position held at 9.9.0.0.0 by 18 Zac. This last position is, of course, the month terminal date of 7.0.0.0.0, 10 Ahau 18 Zac. The glyph in F11 clearly records eighteen Great Cycles, suggesting, perhaps, that eighteen Great Cycles were believed to have ended at 7.0.0.0.0.

Attention has already been called to the way in which the tropical year position of 9.11.0.0.0 was recovered 4,200 years in the future. The count is now projected into the past. The interval between 9.11.0.0.0 and 6.19.18.6.0 is slightly under 1,007 years and 1 day. The interval embraced between the two extremes is 5,127 years, marking the lapse of thirteen Cycles. The calculation can be expressed more clearly by means of a table.

6.19.18. 6.0	Oct. 12.2	Determinant of 7.0.0.0.0
2.11. 1.12.0		1,007 years and 0.8 days
9.11. 0. 0.0	Oct. 13	Katun ending
10. 9. 0. 0.0		4,120 years and 0.9 days
1. 0. 0. 0. 0.0	Oct. 13.9	Great Cycle ending

In other words, when seven times the seven-Katun interval is used, the error is only 27 days (here expressed as 1 year and 27 days for reasons probably connected with the desire to bring Ahau into the equation. If the odd year had not been counted, the position 6.19.19.6.5, 9 Chicchan 8 Cumhu would have been reached, and the ceremonial value of Ahau lost). If the last digit of the Secondary Series leading back to Cycle 7 is read as 1 instead of 0, the calculations are not quite so good, but still astoundingly accurate. The Julian calendar would have accumulated an error of 39 days in this period in comparison with a Maya deviation of 1.7 days from Gregorian, and a slightly larger excess over the latest estimates of the length of the solar year.

The date 9.8.9.13.0, 8 Ahau 13 Pop has yet to be discussed. This date, it will be remembered, is the base from which the count into the future was made. It is closely related both to 9.9.2.4.8, 5 Lamat 1 Mol and to 1.0.0.0.0.8, 5 Lamat 1 Mol. Actually the 8 Ahau 13 Pop date is the anniversary in the tropical year of the 5 Lamat 1 Mol date placed nearest to Cycle 7, the extreme of the range into the past of the long distance calculation. The position is 6.19.0.9.8, 5 Lamat 1 Mol. This is distant 975 years from the 8 Ahau 13 Pop date, requiring a Gregorian correction of 236¾ days. The calculation is: 1 Mol + 237 = 13 Pop. The date 1 Mol at 6.19.0.9.8 occupies the position of March 24 in the solar year. I believe that this can be taken as an attempt, albeit not a very good one, to reach the spring equinox. The distance advanced in the solar year from one extreme to the other is some three and a half years. Thus:

6.19.0.9.8, 5 Lamat 1 Mol	March 24
1.0. 0.0.0.8, 5 Lamat 1 Mol	Oct. 22

The 5 Lamat 1 Mol date at 9.9.2.4.8, is, moreover, a determinant of 9.10.0.0.0, 1 Ahau 8 Kayab, reckoning from the year in which the Katun ends, and not from the year of the determinant (p. 397).

Following the record of the Great Cycle there is recorded at G11-H11 a Calendar Round date 4 Manik 10 Zip. Teeple has suggested the position 19.19.5.10.7 for this date, and reads it as the anniversary of 9.9.2.4.8, 5 Lamat 1 Mol. The interval is 4,143 years, requiring a Gregorian correction of 274¾ days. The calculation is 1 Mol+274=10 Zip. The 4 Manik 10 Zip date is also a determinant of 1.0.0.0.0.0, 10 Ahau 13 Yaxkin. The interval from 13.0.0.0.0, 4 Ahau 8 Cumhu is 7,871 years, requiring a Gregorian correction of 5 years and 82½ days. The calculation is: 10 Zip+83=13 Yaxkin. Teeple, strangely enough, suggests the calculation 10 Zip+91=1 Mol. This must have been due to an error in calculation, since it is 8½ days away from Gregorian. The month position 10 Zip was also, it will be recollected, the determinant of 9.4.0.0.0, 13 Ahau 18 Yax, which started the calculations.

It is pleasant, after such involved calculations, to return to simple figures. At L8 the count switches back to 9.11.0.0.0, 12 Ahau 8 Ceh which served as the center of the long distance determinants and anniversaries. L7-L8 carries a Secondary Series of 6.16.17. This leads to 9.11.6.16.17, 13 Caban 10 Chen (K11-L11), an anniversary of the original 13.0.0.0.0, 4 Ahau 8 Cumhu. The distance from this point to the date in question is 3,772 years, requiring a Gregorian correction of 185 days. The calculation is: 8 Cumhu+187=10 Chen.

The Katun 9.11.0.0.0, 12 Ahau 8 Ceh is repeated at P3-P4, followed at P5-O6 by 9.12.0.0.0, 10 Ahau 8 Yaxkin. There is then an addition of 3.6.6 (O5-P5) leading to 9.12.3.6.6, 7 Cimi 19 Ceh recorded at O7. This may be an anniversary of 1.0.0.0.0.8, 5 Lamat 1 Mol. The interval between the two dates is 4,097 years, calling for a Gregorian correction of 264 days; the Maya correction, if such it is, amounts to 267 days: 19 Ceh+267=1 Mol.

From 9.12.3.6.6, 7 Cimi 19 Ceh there is a subtraction of 9.7.11.3.0. This, given as a Secondary Series at P7-P8, leads to 13.4.12.3.6, 1 Cimi 19 Pax, recorded at O12-P12. The date reached is the summer solstice, but undoubtedly possesses some other significance not at present apparent. After a repetition of the 7 Cimi 19 Ceh date, the count swings back to 9.9.13.0.0, 3 Ahau 3 Uayeb, and thence forward 17 Kins to reach the spring equinox at 9.9.13.0.17, 7 Caban 15 Pop, depicted at Q6-R6.

A Secondary Series of 2.7.6.1 connects the last date with 9.12.0.6.18, 5 Eznab 6 Kankin, which in turn is joined by a Secondary Series to 9.12.10.0.0, 9 Ahau 18 Zotz. The former date, as Teeple has pointed out, is the determinant of the latter. Since 13.0.0.0.0, 4 Ahau 8 Cumhu 3,794 years have whiled, calling for a Gregorian correction of 188 days. The calculation is: 18 Zotz+188=6 Kankin.

Following the Lahuntun ending 9.12.10.0.0, there is a record of 4 Oc linked to 9.12.11.5.18, 6 Eznab 11 Yax by a Secondary Series of 1.8. There is also another glyph adjacent to this Secondary Series, which has a coefficient of 4, but this clearly is not a Tun glyph, nor for that matter a day or month sign. The first date, 9.12.11.4.10, 4 Oc 3 Chen, does not appear to be a determinant, but marks the sun at the zenith. The second date is an anniversary of the original 0 Pop at Cycle 13. The interval is 3,795 years, requiring a Gregorian correction of 190¾ days. The calculation is: 0 Pop+191=11 Yax.

There follows at T6-S7 a Secondary Series of 4.1.10.18. If this is subtracted from the original date, the position 9.8.9.13.0, 8 Ahau 13 Pop is recovered. This has already received comment. The inscription ends with what is, apparently, 8 Oc 3 Kayab recorded at T8. Elsewhere at Palenque this Calendar Round date is found occupying the position 9.12.11.12.10, 8 Oc 3 Kayab. This may be, as pointed out by Teeple, a determinant of 9.12.0.0.0, 10 Ahau 8 Yaxkin. The calculation, however, is not very accurate. It runs: 8 Yaxkin+195=3 Kayab. Gregorian calls for a correction of 191 days. It is probably an earlier and less accurate computation.

There are no further calculations on the panel.

Altogether there are twenty non-Tun–ending dates recorded on the three panels. Of these twelve fall into the determinant or anniversary class. One date is a Calendar Round, the position of which in the Long Count can not be fixed. The remaining seven dates hold significant positions in the Goodman-Thompson correlation. These last dates are noted here, not as possible evidence in favor of the 11.16.0.0.0 correlation, but as possibly being indicative of the Maya methods used to calculate the length of the tropical year should the correlation be correct. These seven dates reach the following positions in the Goodman-Thompson correlation—March 20, 21, and 22, June 22, December 22, August 3, when the sun is about at the zenith in the latitude of Palenque, and April 4. This last date is an anniversary in the Maya year of the original autumnal equinox at Cycle 13. Of course, this last date must be

accepted with considerable doubt as to whether it was the intention of the astronomer so to record it, even should the correlation be correct.

The opening date of the Temple of the Foliated Cross supports to a certain degree the above suggestion. The date reads 1.18.5.4.0, 1 Ahau 13 Mac, reaching November 6 in the proposed correlation. At this time 754 years have lapsed since Cycle 13, requiring a Gregorian correction of 182½ days. This number is exactly half a solar year. Subtracting 182 from November 6, the position May 8 is reached. The sun is overhead within a day in the vicinity of Palenque on May 10 during its northward passage and on August 4 on its return journey. It is possible that this early Initial Series calls attention to the fact that after 754 years the correction amounts to exactly half a year, and that the sun has advanced from the spring crossing of the zenith to the current position November 6. It will be noted that the sun crosses the zenith on its passage northward on or about May 10 at Palenque, but at Quirigua a possible crossing of the zenith has been noted on May 1. The discrepancy is due to the difference in latitude of the two sites. Figures are based on the table used by Mrs. Nuttall.

In contrast to Quirigua, no determinants of the Temple of the Inscriptions appear to be calculated from the 7.6.0.0.0 base. As has been noted, some cities appear to have used both bases, others only the Cycle 13 calculation. The considerable accuracy in calculation attained at Palenque is demonstrated by the table of determinants given on page 403. Here are listed all apparent determinants discussed in the text. Nine of them agree with Gregorian to within one day, two have a one-day error, while the greatest error is four days. This last is so large as to suggest that the date is not actually a determinant.

In a number of places there appear to be lunar factors entering into the calculations. Palenque, using the formula 81 moons = 6.11.12, appears to have considered 9.11.0.0.0 as one day after new moon. The center panel is largely given up to lunar calculations in connection with this date, but their meaning at present eludes us. The interval between 9.4.0.0.0 and its determinant 9.3.8.7.17 is an even number of moons. Such factors may have influenced the choice of determinant dates in addition to the possible desire to reach a lucky day (p. 369). The possible solstice date 9.7.10.3.8 falls on a new moon and 9.12.11.4.10, which may have been a sun at the zenith date, also coincides with new moon. Such matters are

beyond the scope of this publication, but there is little doubt that Teeple was right in believing that moon age played an important part in Secondary Series calculations.

TABULATION OF DETERMINANTS, TEMPLE OF INSCRIPTIONS, PALENQUE

Determinant	Determined	Calculation	Correction Maya	Correction Gregorian	Years
9.3.8.7.17, 10 Caban 10 Zip	Katun 4	10 Zip–18 Yax	148	147	3,616
9.4.0.0.0, 13 Ahau 18 Yax	8 Cumhu	18 Yax–8 Cumhu	150	149¾	3,627
9.8.1.8.10, 2 Oc 8 Kayab	Katun 8	3 Chen–8 Kayab	165	168½	3,706
9.8.9.13.0, 8 Ahau 13 Pop	1 Mol at Cycle 7	1 Mol–13 Pop	237	236¾	975
9.8.17.9.0, 13 Ahau 18 Mac	Katun 9	18 Mac–3 Zotz	170	172¾	3,723
9.9.2.4.8, 5 Lamat 1 Mol	Katun 10	8 Kayab–1 Mol	178	178¼	3,745
9.11.6.16.17, 13 Caban 10 Chen	8 Cumhu	8 Cumhu–10 Chen	187	185	3,772
9.12.0.6.18, 5 Eznab 6 Kankin	Katun 12½	18 Zotz–6 Kankin	188	188	3,784
9.12.3.6.6, 7 Cimi 19 Ceh	1 Mol at Pictun 1	19 Ceh–1 Mol	267	264	4,097
9.12.11.5.18, 6 Eznab 11 Yax	0 Pop	0 Pop–11 Yax	191	191	3,797
9.12.11.12.10, 8 Oc 3 Kayab	Katun 12	8 Yaxkin–3 Kayab	195	191	3,797
6.19.18.6.0, 8 Ahau 8 Cumhu	Katun 9 at Cycle 7	8 Cumhu–8 Zac	235	234¾	967
	Katun 11 Anniversary	8 Cumhu–8 Ceh	245	244¼	1,007
19.19.5.10.7, 4 Manik 10 Zip	1 Mol at 9.9.2.4.8.	1 Mol–10 Zip	274	274¾	4,143
	Pictun 1	10 Zip–13 Yaxkin	83	82½	7,871
1.0.0.0.0.0, 10 Ahau 13 Yaxkin	Katun 11 Anniversary	8 Ceh–13 Yaxkin	270	269	4,120

APPENDIX I

OCCURRENCES OF THE LONG-NOSED RAIN GOD GLYPH

At Quirigua

Stela J. 12 Caban 5 Kayab the associated date. A determinant (p. 372). Head form of glyph.

Stela F. 12 Caban 5 Kayab the associated date. Normal form of glyph.

6 Cimi 4 Tzec the associated date. A determinant (p. 375). Head form of glyph.

Stela D. 7 Ahau 3 Pop the associated date. A determinant (p. 378). Normal form of glyph.

Stela E. 12 Caban 5 Kayab the associated date. Normal form of glyph.

6 Cimi 4 Tzec the associated date. Normal form of glyph, which is repeated in the summary at the end of the inscription.

Stela A. 6 Ahau 13 Chen the associated date. A determinant (p. 380). Normal form of glyph.

Altar P. Apparently associated with Baktun 13. Normal form of glyph.

At Palenque

Temple of the Foliated Cross. 1 Cauac 7 Yax the associated date. Spinden (p. 85) makes a curious mistake in connection with this date, reading the cartouche enclosed 1 Cauac as 1 Tun, and reaching a date 10 Cauac 2 Yax. The date is clearly 1.18.6.0.19, 1 Cauac 7 Yax. This appears to be a determinant of Cycle 2, 2 Ahau 3 Uayeb. The date is 754 years after Cycle 13, requiring a correction of 181 days at 24 days a century: 7 Yax+176=3 Uayeb.

2 Ahau 3 Uayeb is the associated date. A determinant (Teeple, p. 78). The full-figure glyph is used.

2 Cib 14 Mol is the associated date. A determinant (Teeple, p. 77). The full-figure variant is used twice in connection with this date.

Temple of the Sun. 9 Manik 10 Tzec is the associated date. It is joined to the Initial Series by a Secondary Series of 1.11.1, which is written 1.11.2. This date appears to be a determinant of 9.10.10.0.0, 13 Ahau 18 Kankin calculated on a 24-day a century

basis. The date is 755 years from Cycle 13, requiring a correction of 182 at the rate of 24 days a century: 18 Kankin+177=10 Tzec. The calculation is exactly similar to the 1 Cauac 7 Yax date of the Temple of the Foliated Cross, running five days below the required calculation. This must represent an earlier form of reckoning. The glyph is the normal form.

Temple of the Inscriptions. The Initial Series 9.4.0.0.0, 13 Ahau 18 Yax is the associated date. This is a determinant of 8 Cumhu at Cycle 13. The interval is 3,627 years, which gives a correction of 150 days by strict Gregorian: 18 Yax+150=8 Cumhu. The importance of this date lies in the fact that as a Katun ending it is also a determinant of 8 Cumhu. The glyph is the normal form.

The Katun ending 9.11.0.0.0, 12 Ahau 8 Ceh is the associated date (p. 398). The variant is the full-figure glyph repeated twice, possibly to indicate that it is a determinant of a determinant.

The next associated date is 9.11.6.16.17, 13 Caban 10 Chen. This is a determinant of 8 Cumhu at Cycle 13. Since then 3,772 years have whiled, requiring a Gregorian correction of 185 days: 8 Cumhu+187=10 Chen. Head variant of glyph.

AT COPAN

Stela A. The associated date is 9.14.19.8.0, 12 Ahau 18 Cumhu, determinant of Katun 15, 4 Ahau 13 Yax (p. 374). The glyph is the head form.

Stela B. Apparently associated with 9.15.0.0.0, 4 Ahau 13 Yax (p. 373). The glyph is the normal variant.

Stela I. The association is not certain, but is possibly with 9.12.3.13.0, 5 Ahau 8 Uo, which reaches the spring equinox in the Goodman-Thompson correlation.

Stela J. The dates 9.0.0.0.0 and 9.13.10.0.0 are associated, but I fail to see any connection, unless the glyph is merely inserted to indicate a count extending over some 260 years. There is also an obliterated count of 4 Uinals 4 Kins, which might throw more light on the subject. Normal form.

Altar K. The glyph is associated with the Initial Series 9.12.16.7.8, 3 Lamat 16 Yax, which is a determinant of 8 Uo, the month position of 9.13.0.0.0. Since Cycle 13, 3,801 years have whiled, requiring a Gregorian correction of 191 days: 8 Uo+188=16 Yax. The head form is employed.

Stela N. The determinant glyph is associated with the great distance number of more than seventeen Cycles. This has never been satisfactorily read. The glyph is the head variant.

Pedestal of Stela N. The glyph occurs twice. One date is 9.16.13.4.15, 6 Men 3 Yaxkin, an apparent determinant based on 7.6.0.0.0. There is an interval of 999 years, requiring a Gregorian correction of 242 days: 3 Yaxkin+242=0 Pop.

Altar Q. The glyph is found with 9.15.6.16.17, 5 Caban 15 Yaxkin, which marks the summer solstice in the Goodman-Thompson correlation. The head form is used.

The associated date is 9.15.7.6.13, 5 Ben 11 Muan. This appears to be a determinant of the current Katun ending 9.16.0.0.0, 2 Ahau 13 Tzec from a 7.6.0.0.0 base. The interval is 974 years, requiring a correction of 236 days by Gregorian: 13 Tzec+238=11 Muan. The glyph is of the head variant type.

Altar R. The glyph is found with the date 6 Caban 10 Mol, a determinant (Teeple, p. 74). Head variant of glyph with coefficient of 9.

Stela 1. The Initial Series, 9.11.15.14.0, 11 Ahau 8 Zotz. The sun is at the zenith on this date according to the Goodman-Thompson correlation.

Stela 8. The dates 9.16.12.5.17, 6 Caban 10 Mol and 9.17.12.6.2, 9 Ik 15 Zip appear to be associated. The first is a determinant, the second falls within a day of the spring equinox, and is the Katun anniversary of 6 Caban 10 Mol plus five days to take care of intercalation in a Katun. In order to qualify as a determinant, the five days should have been subtracted, not added. The glyph belongs to the head variant group.

Other examples of this glyph occur at other cities, and in a future publication the question of determinants at Naranjo and Yaxchilan will be taken up.

APPENDIX II

ON THE SPREAD OF THE SACRED ALMANAC

At the time of the Spanish conquest the 260-day sacred almanac was in common use over a large area of Middle America. It has been claimed that this count originated among the Mayas, spreading thence through Zapotecan territory into the Valley of Mexico. This has been the theory generally accepted by English-speaking Americanists. Recently Spinden has put forward evidence which in his opinion proves that the nebulous Quetzalcoatl introduced the calendar into the Mexican plateau from Yucatan in A.D. 1191. However, as his argument for this importation is based very largely on a correlation of the Maya and Christian calendars, which so far has not received general acceptance among his fellow workers in the Maya field, the question still remains open.

The Nahua-speaking Nicarao of Nicaragua are generally believed to have migrated to their present homes about the time of the overthrow of the "Toltec Empire" in the twelfth century of our era (Lothrop, pp. 5 and 8; Joyce, p. 8). They took with them a knowledge of the 260-day count, employing, however, Toltec spelling in place of the later Aztec. Acat, for example, was used instead of Acatl, and Ozomate for Ozomatli. The names of a number of Nicarao deities are given by Oviedo, and several of these can be recognized as well-known Mexican deities, such as Mixcoatl and Mictlantecutli. Quetzalcoatl, however, does not figure in the list. From this one might infer that the Nicarao left Mexico before the time of Quetzalcoatl, since had they migrated after his time they could scarcely have failed to incorporate his worship in their religion; for Quetzalcoatl became the greatest deity of the Toltec pantheon. The evidence, of course, is negative, but, such as it is, suggests that the 260-day count was known to the Toltecs before the time of Quetzalcoatl.

On comparing Maya day names from Yucatan and the Highlands of Guatemala with those of the Aztecs, it is clear that the Guatemalan Maya names are closer to the Aztec than are those of Yucatan. Only the Maya equivalents of two Aztec day names can be definitely found in the Yucatecan list. These are "wind" and "death." In two or three other cases a connection can be traced through other Maya languages. The Yucatecan equivalent of the Aztec Coatl, meaning "snake," is Chicchan. This is meaningless in Yucatecan,

but Chan is the name for "snake" in several southern dialects, and Chicchan, Mr. Charles Wisdom informs me, is the name of a snake deity among the Chorti. Ix, or, as some of the old writers say, Hix, has no particular meaning in Yucatecan Maya, but Hix in Kekchi is "jaguar," corresponding to the Aztec Ocelotl. In the same way Oc does not show the required resemblance to the Aztec Itzcuintli, meaning "dog." Ok, however, is the Motozintleca word for "coyote," and among the Tzeltal and Tzotzil the closely allied Okil is used. Cauac, too, appears to be derived from a word signifying "rain-storm." It is probable that most of the Yucatecan day names are derived from archaic words that have now gone out of general use, but have survived, sometimes, in one or two Maya languages.

On the other hand among the day names preserved in the Highlands of Guatemala the correspondences with Aztec are more numerous. Lothrop (1928, p. 654) calls attention to the fact that frequently where the Highland root differs from the Yucatecan, the former is related in meaning to the Aztec. He lists seven day names of this nature, and from Termer's Chuj list we can add Quixcab, corresponding to the Aztec Ollin, in addition to the two Yucatecan days, the Highland equivalents of which also have the same meaning.

As the Highland names are so much closer to Aztec, it seems more probable that the Mexicans derived their count from the Highlands than from Yucatan. The Highland calendar obviously was not derived from Mexico, since it is more advanced in its possession of a year count.

We have seen that the Yucatecan day Oc may well be derived from an archaic root with the meaning "coyote." The Highland tribes used for this day words meaning "dog." Had the calendar been carried direct from Yucatan to the Mexican plateau, the word "coyote" would have been used instead of "dog." The use of Itzcuintli supports a derivation from the southern area.

Seler, in his researches into the origin of the Zapotecan calendar, comes to the conclusion that it was intermediate between the Maya and Mexican plateau counts. Although a number of his derivations are somewhat far-fetched, the third day sign appears definitely to mean "darkness." This is a correspondence with the Maya equivalent "day," which has the meaning "night," and not the Aztec name, which means "house." This is a strong point in favor of Seler's theory. It may well be that the Zapotecan and Maya calendars were derived from the same source. Evidence of archaeological influences from the Maya area into Oaxaca has been greatly

strengthened by the recent discovery of vaulted chambers at Monte Alban, although these probably represent a much later cultural wave. It is also possible that the calendar spread up the east coast, and that the Zapotecan calendar was derived from an offshoot.

Finally, had the calendar been taken by Quetzalcoatl direct from Yucatan, it is unlikely that the Long Count would not have been introduced into central Mexico at the same time. The Katun round played an enormously important part in Yucatecan chronology, and could scarcely fail to have been taken over with the rest of the complex. From its absence in central Mexico we may, perhaps, infer that the spread toward Mexico started before the invention of the Long Count and before Maya culture developed its specialized form. In other words that the 260-day sacred almanac was a pre-Maya invention and spread on an early horizon. This conclusion was suggested by Tozzer some years ago (1916), but subsequently abandoned by him (1927). There was certainly time to develop such a count before the rise of the Mayas. In a previous discussion of the origin of the sacred almanac (Thompson, 1931, p. 352) I suggested that a long time probably elapsed between the evolution of the 260-day sacred almanac and the invention of the Long Count.

In connection with the day count a question has recently arisen as to whether the Mayas counted from new or full moon. From literary sources there is only one known statement as to which base was used by the Mayas. This is the statement of Bishop Landa that the count was from new moon. Actually this statement probably came from one of Landa's principal Maya informants, Gaspar Antonio Chi or Juan Cocom (Blom), both of whom were of royal descent, and presumably well acquainted with the calendar on that account.

Turning to Mexico, however, we find information strongly suggesting that the Aztecs reckoned from new moon. Sahagun (bk. VII, chap. 2) says, "Little by little it [the moon] wanes until it is as it started [at new moon]. Then they say, 'Now the moon dies; now it sleeps a lot.' That is when it rises at dawn. At the time of conjunction they say, 'Now the moon is dead.'" The Yucatecans said that the moon was going away when it had almost completed the waning phase. Both expressions carry with them the idea of ending and completion.

Serna (chap. VII) says that there was a lunar count in addition to that of the regular twenty-day months. He writes, "He [Martin de Leon] says that the Mexicans had two kinds of computa-

tions of their years; the first was natural from one summer to another, or rather from one spring to another, according to the annual revolution of the sun, and all these barbarous nations observed this in connection with their agriculture—nobles and commoners, peasants and educated persons. Our natural summer in New Spain, as we know from our own experience, commences in the month of February, for at this time the south winds begin to blow, the earth begins to warm and the trees to flower. The months, like those of the Hebrews, were counted from one neomenia to another; that is, from one appearance of the moon to another, as the very names of the year show, since in Mexican the year is called Xihuitl, which means grass; and thus the whole year was counted from the time the trees and plants began to bud, and in the same way the name of the month is derived from that of the moon, which is called Meztli. Thus one month is called Cemeztli, and by this count the women reckon their months of pregnancy. I have seen that in other [religious] provinces and other bishoprics, Oaxaca for example, they have their idolatries and reckon by thirteen months with thirteen gods, each month with its own patron god."

The reference to thirteen months apparently cannot refer to the thirteen divisions of the Tonalamatl, since this is explained in full elsewhere in the text, and in any case was considered to have twenty divisions rather than thirteen. Serna's discussion is somewhat involved, but his reference to the start of the lunar count is clear. I have made slight alterations in punctuation where this was absolutely necessary to make sense.

In the Codex Telleriano-Remensis, Part IV, plate 26, there is the following comment: "In the year 5 Rabbit [1510] there was an eclipse of the sun. No attention was ever paid to lunar eclipses, but only to those of the sun, for they said that the sun ate the moon when a lunar eclipse took place." This statement would seem to argue against a count from full moon, for it is precisely at this time that lunar eclipses occur. Mexican and Maya beliefs and practices were so similar in other ways, as for example in the Venus count and associated beliefs, that it is extremely unlikely that they would differ in the lunar count.

Ethnological information as to the lunar count of the modern Mayas is, unfortunately, almost non-existent. E. P. Dieseldorff, of Coban, has been kind enough to send me the following information with regard to the Kekchi and Pokomchi lunar counts. Among the Kekchi the new moon period is called "The moon is born"; the first

quarter is called "the half of the moon"; the meaning of the Kekchi equivalent of full moon cannot be translated, but for last quarter they say, "The moon sleeps." The Pokomchi expressions are the same, except that the full moon is called "full moon." Mr. Dieseldorff adds the following very important paragraph: "In the Carcha district the Kekchi Indians say for new moon *x'cam li po*, 'The moon is dead.' It is therefore probable, to my mind, that the counting began with the new moon, as they say also *ac li po*, 'new moon,' for the first days of the new moon."

This checks well with Sahagun's information on the Aztec lunar count, although a doubt remains as to whether the moon died at the disappearance of the old moon or the appearance of the new. A similar doubt exists as to the death of Quetzalcoatl as lord of the planet Venus. In the same version we are told that he died when the morning star appeared and also that he died eight days earlier when the planet disappeared prior to inferior conjunction. As the Venus year ended in death, we can deduce by analogy that the lunar count also concluded with death. It is hardly credible that the moon would have been believed to die and be reborn in the middle of its course, which would be the case if the reckoning was from full moon to full moon. Clearly death, as in the case of the Venus count, marks finality.

Finally attention should be called to the evidence supplied by the Maya lunar glyphs themselves. This point is brought out in a letter written by me to Carl Guthe, and published in his article "The Maya Lunar Count" (*Science*, LXXV, 1932, pp. 271–277).

The evidence, such as it is, from sixteenth century Mexican and Maya sources, from the Codex Telleriano-Remensis, from the present day Kekchis, and from the hieroglyphs themselves, points to a count from new moon among the Mayas. It would, indeed, be strange were the count to have been from full moon, for an examination of the scanty information on native lunar counts has revealed to me no information on a lunar count from full moon to full moon used by any tribe between Canada and Tierra del Fuego. Radloff (*fide* Ginzel) speaks of the Kaigani branch of the Haida counting their moons from new moon, but says the days were counted both from new moon and full moon. George P. Murdoch, who was engaged this summer in ethnological work among the Haida in behalf of the Department of Anthropology of Yale University, was kind enough to inquire into this matter for me. In a letter, dated September 7, 1932, he writes: "I delayed answering until I came here to Alaska

to check up among the Haida certain of my findings at Massett and Skidegate. I have made every effort here to answer the questions raised in your letter, and the following is what I have learned from two informants.

"The Alaskan Haida did not count the days of their months from both new and full moons as stated by Radloff, nor did they reckon differently in summer and winter as you suggest. Throughout the year, in all seasons, they reckoned from the new moon only. To be precise, each month began on the second day of the new moon. The day of the first appearance of the thin crescent was counted as the last day of the old month. The next day, when the moon 'looked three fingers broad' was the first day of the new month."

I had suspected that Radloff's statement of a count from full moon might have been due to his having been confused by the naming of the summer low tides, to which Swanton refers in his paper on the Haida calendar. These, however, play no part in the lunar count, for Murdoch writes: "The relation of moon and tides was known, of course, but both informants insist that the moon rather than the tides was the primary criterion in time reckoning."

Thus the one exception to the apparently universal Indian custom of reckoning from new moon or its immediate vicinity proves on examination to be nothing of the sort.

Ludendorff suggests that as the Mayas invented such things as zero and positional numeration, they may also have differed from other American Indian tribes in counting from full moon. Surely the two are not comparable since zero is a definite discovery that greatly simplified Maya arithmetic. The substitution of a count from full moon for one from new moon would in no degree be a progressive step such as would overcome conservatism. The extreme reluctance of mankind to make alterations which are definitely advantageous, has been pointed out by Kroeber and others. One might point to a close analogy in the slow progress made by the movement for a thirteen month year at the present time, although such a system is universally recognized to be an improvement on our present system. What reason have we, then, for supposing the Mayas succeeded in overcoming this innate opposition to change when the new system had no advantages over the old? There was certainly no strong theocracy at the early date assumed for the change, such as might have forced the issue, and had such existed

are we to assume that its members lacked that conservative instinct inherent in all organized religion?

The evidence of Landa himself, of early Mexican sources, of the present day Kekchi count, of the Maya glyphs and of the unity of the lunar counts of American Indian tribes, while not entirely conclusive, points overwhelmingly to the Maya lunar count not having been made from a full moon base.

APPENDIX III

AZTEC AND MAYA LORDS OF THE NIGHTS

At first glance there appears to be little resemblance between the Aztec lords of the nights and the equivalent Maya glyphs (J. E. Thompson, 1929). The Aztec list was composed of the following deities arranged in the same order as they are listed here: Xiuhtecutli, Itztli, Piltzintecutli, Centeotl, Mictlantecutli, Chalchihuitlicue, Tlazolteotl, Tepeyollotl and Tlaloc.

Only one glyph is recognizable in the Maya list. That is the first of the series, which is unmistakably the sun god. In the Aztec list the third name, Piltzintecutli, is a minor title of the Aztec sun god, Tonatiuh. If the two series are placed side by side so that the sun gods in both lists coincide, we shall see which deities should also correspond.

Aztec		Maya
Name	Meaning	Features
1. Xiuhtecutli	Fire god.	7. God with flame bracket.
2. Itztli	Obsidian god.	8. No example recorded.
3. Piltzintecutli	Sun god.	0. Sun god. Sometimes with leaves.
4. Centeotl	Maize god.	1. Nine god and hand.
5. Mictlantecutli	Death god.	2. Three with nondescript glyph.
6. Chalchihuitlicue	Water goddess.	3. Glyph like Mol.
7. Tlazolteotl	Earth goddess.	4. Seven goddess or god.
8. Tepeyollotl	Mountain god.	5. Five with nondescript glyph.
9. Tlaloc	Rain god.	6. Nondescript glyph.

The first in the Aztec series is the fire god, and the Maya equivalent has a flame bracket branching out from the god's mouth in all of the three occasions where it is represented in the inscriptions, while in one case there are also three balls of flame above the head. The connection between Aztec and Maya is in this case pretty clear.

Itztli, the obsidian form of Tezcatlipoca, is the second of the Aztec series, but there is no known example of the Maya equivalent.

The third Aztec lord of the night is Piltzintecutli, the sun god, and as already pointed out, the Maya equivalent is also the well-known Maya sun god, known in Yucatan as Kinich Ahau. In the list of the lords of the nights given in Leon y Gama, the equivalent position is occupied by flower. Elsewhere (Thompson, 1932) I have shown that the sun and flower are so intimately connected that in Aztec the flower glyph (Xochitl) replaced the Maya sun glyph (Ahau, Ahpu, etc.) as the last of the twenty days. It will also be recalled that leaves are sometimes shown growing from the head of the sun god when it is used as a lord of the night. As the twentieth

day the sun god is shown as the young hunter during his career on earth, frequently with a round spot on his face as in the Aztec representations. He is shown with the four-petaled flower or as an old god with filed teeth to represent the Kin glyph, and with the same features, the four-petaled flower and leaves or three shells as lord of the night. The shells are the symbol of the moon, his wife, and here must be used to denote the night manifestation of the sun. Similarly in the Codex Borbonicus he is shown with a shell above him, and here he represents the sun by night with his body and part of his face painted dark.

The fourth Aztec lord of the night is Centeotl, the maize god. The corresponding Maya glyph shows a head with a numerical coefficient of nine and a large human hand. When the discovery of the Maya lords of the nights was announced in 1929, it was suggested that these coefficients represented part of the deity's names. An important Yucatecan deity was Ah Bolon Tzacab, whose name has been translated as "Nine Generations" or "Nine Orders." He was associated with the Kan years as recorded by Landa, and also figures as an agricultural deity in the Chumayel account of the creation. Seler has identified his glyph as that which has been suggested above as a determinant glyph (p. 387). The two identifications are not incompatible, for it has already been pointed out that the chief features of this glyph denote a deity closely associated with the rainy season and vegetation, the snake nose representing the first, the leaves on the forehead the second. This deity is also shown occasionally with both a hand and a numerical coefficient of nine, thus establishing his identity with the Glyph G in question. All in all, then, the evidence shows that the god treated of here is an agricultural deity, and that he is the equivalent of the Yucatecan Bolon Tzacab. The fact that as lord of the night he does not show the ophidian features is not an argument against this identification, since this differentiation was probably required to avoid confusion when the same deity was used as the basis of different glyphs. It would seem then that the Maya glyph equates with the Aztec Centeotl, both representing agricultural gods.

The fifth deity in the Aztec series is Mictlantecutli, the death god. The corresponding Maya glyph is only represented by two examples, one of which is partially obliterated; the second comes from the very late Chichen Itza Initial Series lintel. The latter has an apparent coefficient of three. The connection with death is not evident.

The sixth Aztec lord of the night is Chalchihuitlicue, goddess of water. The equivalent Maya glyph resembles the month sign Mol. This in turn is very closely associated with the day sign Muluc, for the central elements in both glyphs are the same. Muluc is the equivalent of the Aztec day sign Atl, which means "water." It is clear that both Muluc and Mol were once very closely identified with water. Unfortunately the equivalent Highland Maya day signs have also lost their meanings. Nevertheless, through the Aztec identification we are justified in associating this lord of the night with water, and hence with Chalchihuitlicue. Indeed, in the list given by Leon y Gama of the Aztec lords of the nights water is substituted for Chalchihuitlicue.

The seventh Aztec deity is Tlazolteotl, an earth and maize goddess and patroness of sexual indulgence. She, Chicomecoatl ("Seven Snake"), a goddess of maize, and Xochiquetzal, goddess of agriculture, weaving, sexual indulgence, and the moon were much confused in Aztec minds, merging one into another both in attributes and functions. The Maya equivalent is a youthful deity, probably a goddess with a numerical coefficient of seven and apparent lunar features. Chicomecoatl, we have seen, carried the numeral seven in her name, and was also known as Chicomolotl ("Seven Maize Ear"), while Xochiquetzal's festival was celebrated on the day 7 Xochitl. Both Tlazolteotl and Xochiquetzal were reported to have been the first women to cohabit with man, the man in the latter case being the sun god during his sojourn on earth. Xochiquetzal can be equated with the moon goddess, while Tlazolteotl wears the lunar nose plug, and must also have been originally the moon goddess, since it was the moon who first cohabited with the sun.

Thus in Mexican mythology we have the following concepts inextricably woven together—moon goddess, agriculture, first cohabitation, wife of the sun, patroness of weaving, association with the number seven, sexual indulgence, and flowers. On the Maya side we have the moon goddess, who was believed to be the inventress and patroness of weaving, the wife of the sun, and the first woman to cohabit, and who was associated with flowers and, by extension, with agriculture. She was also guilty of adultery, and so may be said to have given a lead to sexual indulgence (Thompson, 1932). All that is lacking to make the association complete is her association with the number seven. This is not at present forthcoming, but it must be remembered that all we know of Maya mythology and religious concepts is a mere fraction of the beliefs of two or three

Maya peoples, not direct inheritors of Old Empire tradition. There is clearly a link between the Maya and the Aztec seventh lord of the night.

The eighth Aztec lord of the night is Tepeyollotl, a somewhat obscure earth and mountain deity, whose name means "Heart of the Mountain." His position as a mountain deity is well brought out in the codices Aubin and Borbonicus, where the main element of his glyph is a mountain. The god is also depicted as a jaguar-like animal, and his symbol is a conch shell.

The equivalent Maya glyph invariably carries a coefficient of five. The rest of the glyph shows considerable variation.

An aged and malevolent deity is frequently depicted on Maya pottery from the Alta Vera Paz region wearing a conch shell upon his back. Sometimes he is shown emerging from the shell. This deity, either with or without the shell, occurs in the codices, and has been recognized by Forstemann and Schellhas as the god of the five unlucky days. This deity, Cogolludo tells us, was called Mam. His glyph is the Tun head-dress or the number five attached to an old face or the Cauac-Tun glyph. His head, surmounted by the Tun sign, is used to denote the number five in the inscriptions of the early period.

Mam is also the name of a group of mountain-valley gods of the Mopan Mayas of southern British Honduras (Thompson, 1929), and the name is also given to certain mountain deities among the Pokomchi and Kekchi Mayas. The word itself means among other things one's mother's father in Yucatecan, and as a reciprocal word for grandfather seems to be common to most, if not all, Maya languages.

On the Aztec side there is, then, a mountain god, whose symbol is a conch shell, on the Maya side a Maya mountain god, whose symbol is also a shell, and who appears also to have presided over the five days at the end of the year, from which he derived his association with the number five occurring in his glyph. It is clear that an association between the Aztec and Maya lords of the night of the eighth position exists.

The last of the Aztec series is Tlaloc, the rain god. The equivalent Maya glyph is a young deity with an ear-flap, and the association is not evident. Only two examples of the Maya glyph are known, and it may be that with further examples a connection will appear.

Placing the two series side by side, the following resemblances are now visible:

Aztec	Maya
1. Fire god.	7. Fire god.
2. Obsidian god.	8. No example recorded.
3. Sun god.	9. Sun god.
4. Maize god.	1. Agricultural god.
5. Death god.	2. No apparent resemblance.
6. Water goddess.	3. Water glyph.
7. Earth-weaving-pleasure-moon goddess.	4. Weaving-pleasure-moon goddess?
8. Mountain god.	5. Old mountain god, patron of five unlucky days.
9. Rain god.	6. No apparent resemblance.

In six of the nine-night sequence a remarkable coincidence between Aztec and Maya is either apparent, or can be reached through our scant knowledge of Maya mythology. Of the three cases where the resemblance is wanting, one lacks any recorded Maya example, and the other two are represented in the Maya series by only two examples apiece.

Since the original publication of the Maya series, the following additional examples of lords of the nights, other than the sun god, should be noted.

Number one, the agricultural god, with the coefficient of nine and the hand, is to be seen on Lintel 3 at Piedras Negras, found by J. Alden Mason, leader of the University of Pennsylvania Expedition to Piedras Negras (Bull. Univ. Mus., III, plate I). A second example was recorded on Date 25 of the Hieroglyphic Stairway at Copan (J. E. Thompson, 1931, p. 347), and a third on Date 26 of the same monument (Thompson, *loc. cit.*).

Number five of the series is excellently illustrated on Lintel 48 at Yaxchilan discovered by Karl Ruppert and illustrated by Morley (1931). Doubtlessly others will be found when more non-Tun-ending dates are discovered.

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